EDITORIAL

THE present rate of technical progress is such that it tends to make one rather blase about new developments. However, readers with a prime interest in "radio" could not fail to be stirred by a couple of items which featured in the news during the past month.

One report stated that Britain was on the verge of beating the immediate threat of nuclear submarines—their ability to move in on a target, unobserved, and, while still submerged, to launch missiles carrying atomic warheads.

Using what is described as a completely new technique, British scientists claim that they will be able to detect submerged submarines more than 1,000 miles away and to take appropriate defensive measures, even though the submarines may be travelling very fast. Speeds of around 100 m.p.h. have been mentioned for underwater "spaceships" at present on the drawing boards.

The other item concerns the U.S. Pioneer Five satellite, which is currently reported as being something like ten million miles out in space. Over most of this distance, its signals have been sent back to earth using a tiny 5-watt transmitter.

At eight million miles, it was decided to bring the larger 150-watt transmitter into use and the necessary "instruction" was sent to the satellite from Britain's Joddrell Bank installation. Ninety seconds later a return signal from the satellite indicated that the large transmitter was in operation.

Powered by batteries charged by solar energy, there is no reason to doubt that the transmitter will continue to send back scientific information for quite a while yet, as the satellite continues on its way. British and U.S. scientists have estimated that signals should be effective over distances exceeding 60-million miles.

Every day, as Pioneer Five speeds onwards, our radio horizon is broadening. Soon the embarrassment to space communication will not be distance, but time. At sixty million miles it will take ten minutes to receive acknowledgment from the satellite. Inevitably and perhaps very soon we will be faced by a lapse of days, of weeks, of years.

Scientists will need to learn a rather bitter lesson of patience. It would seem almost the ultimate in frustration to have to work at initiating space signals, in the full knowledge that one could not live to see their return or acknowledgment. That is, unless scientists, meanwhile, solve the riddle of time or of life itself.

In the meantime, those who years ago conceived and built the radio telescope at Joddrell Bank must be feeling very happy with their efforts. Without Joddrell Bank, the present work with Pioneer Five would not have been possible.

W. N. Williams

INDEX

	Page
330 kv. at 1200 amps.	3
Watts Come By The Billion	4
Complete TV System In Space	9
Auto Engine Without Pistons	13
Trees Prevent Erosion	16
Review — Fluid Amplifier	21
Review — Thermoplastic Recording	23
Review — Fluorescent Rail Lights	25
News and Views Of The Month	29
Amplifier For Tape Decks	32
The Serviceman Who Tells	45
All-wave Transistor Set	52
A Reader Built It	59
Here's Your Answer, Tom	60
Rebuilding Your C.R.O.	64
High Gain With Frame Grids	75
Video Recording Developments	79
Trade Reviews	85
Let's Buy An Argument	92
Off The Record	96
In Review by Julian Russell	101
Book Reviews	109
Amateur Bands	112
On Shortwave	117
Answers To Correspondents	121
Index To Volume 19	125
"R, TV and H" Crossword	127

RADIO ★★ TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION HOBBIES AND POPULAR SCIENCE

EDITOR
NEVILLE WILLIAMS
M.I.R.E. (Aust.) (VK2XV)

TECHNICAL EDITOR
PHILIP WATSON
A.M.I.R.E. (Aust.)

TECHNICAL STAFF
JOHN BARKER
WES YASHIN
BRIAN CLEAVES
JAMIESON ROWE
MERVYN HUDDLESTON

Vol. 22 No. 3

SUBSCRIPTION RATES

C'wealth, Fiji, N. Guinea, £1/15/- p.a.
United Kingdom and N.Z., £A2 p.a.
British Dominions £A2 p.a.
Foreign £A2/10/- p.a.

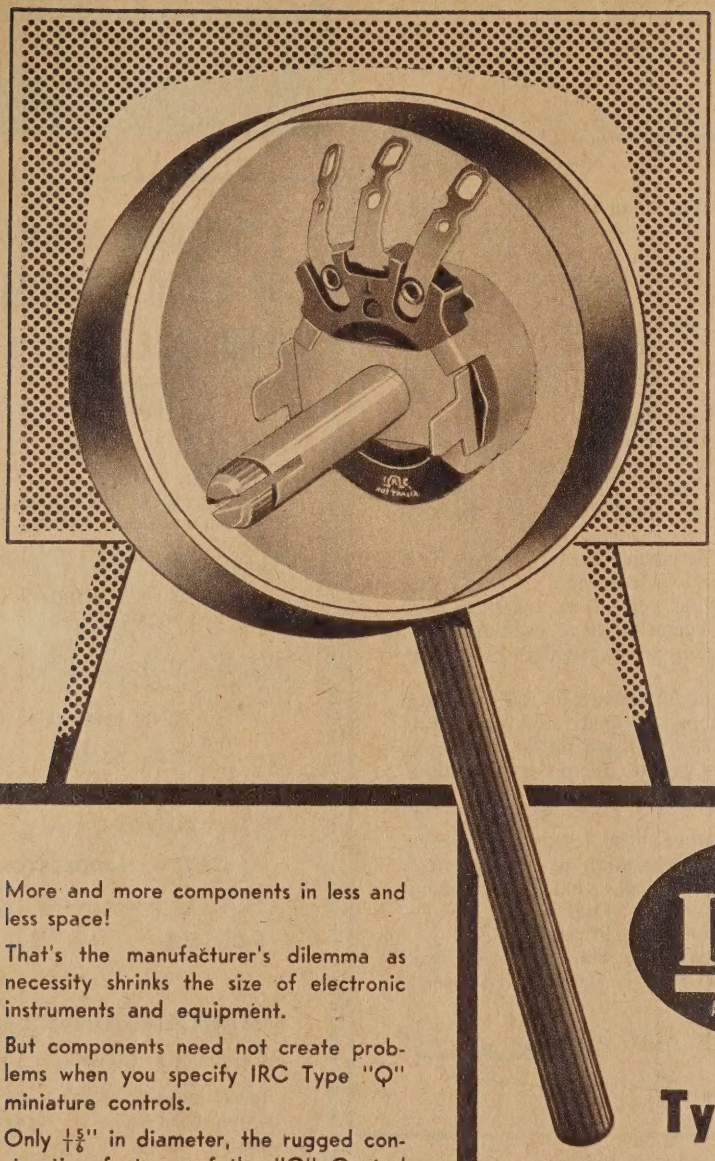
Editorial Offices . . . Jones St., Broadway, Sydney.

Postal Address . . . Box 2728 G.P.O., Sydney.

Phone ---------- B0944

OUR COVER PICTURE

What technically minded person can ignore the facination of a true-to-scale model railway? In this picture, the camera caught telephone technician, Frank Maxwell, of Chatswood, NSW, repairing a broken rail link.



Where *miniature* Volume Controls are a must . . . !

More and more components in less and less space!

That's the manufacturer's dilemma as necessity shrinks the size of electronic instruments and equipment.

But components need not create problems when you specify IRC Type "Q" miniature controls.

Only $\frac{5}{16}$" in diameter, the rugged construction features of the "Q" Control include the finest resistance element IRC has ever produced. The "Q" Control's low noise level and negligible change in resistance, even after long exposure to humidity, make it readily adaptable to a wide range of small-space applications.

IRC controls are available in the most comprehensive range of resistance values and combinations.

Contact your usual supplier for illustrated literature.

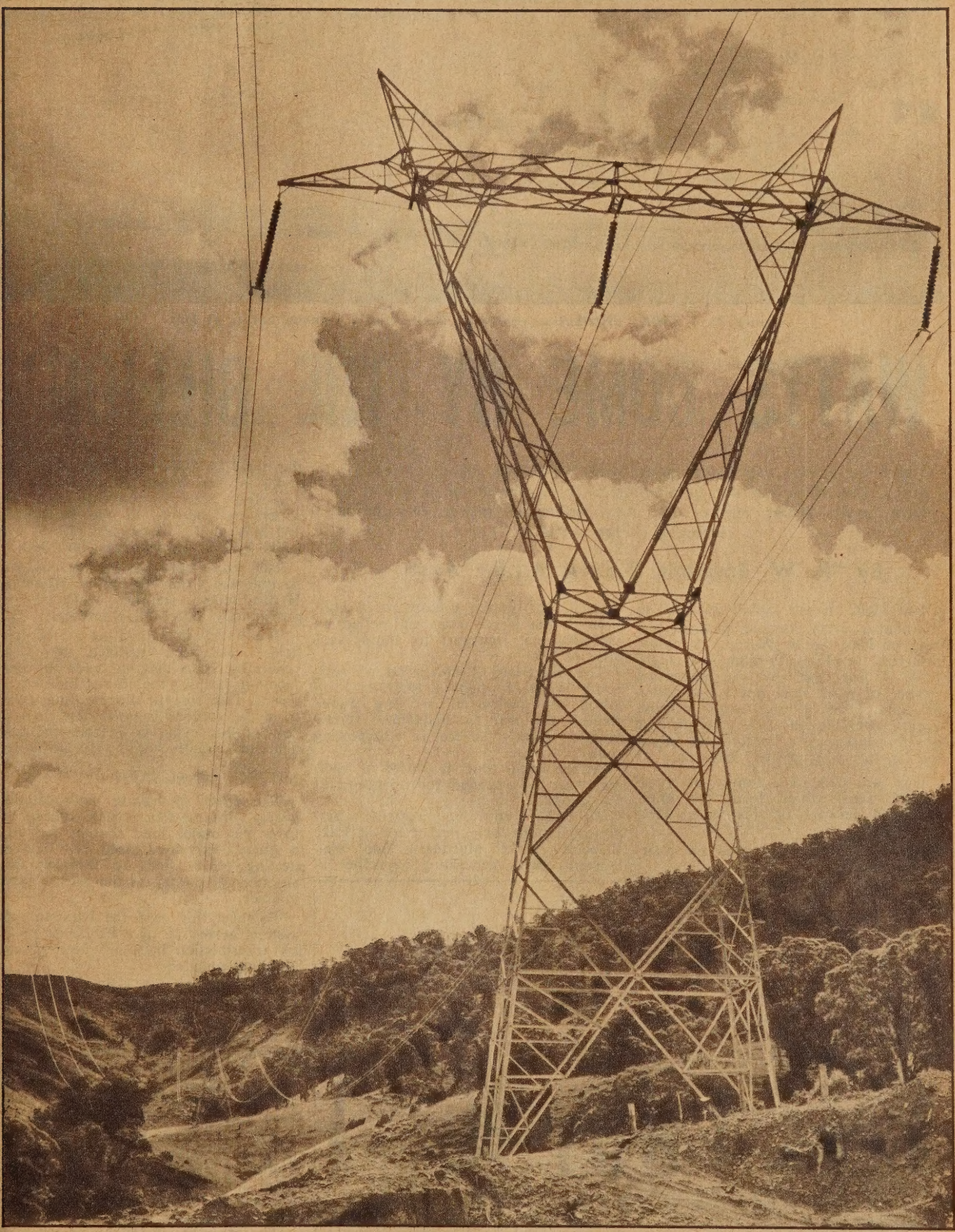
IRC AUSTRALIA

Type Q MINIATURE CONTROLS

are the answer!

Sole Australian Agents:
Wm. J. McLELLAN & CO. PTY. LTD.
126 Sussex Street, Sydney. BX 1131
Victorian Agents: Australasian Engineering Equipment Co. Pty. Ltd., 476 Latrobe Street, Melbourne. FY 2638

330 KILOVOLTS AT 1200 AMPS!



Part of a vast distribution network spreading across New South Wales, these huge towers support lines carrying 330,000 volts. The twin conductors can carry up to 1,200 amperes without exceeding safe operating temperature. Spans range up to 4,000 feet in length—three-quarters of a mile (Figure 1, see article next page).

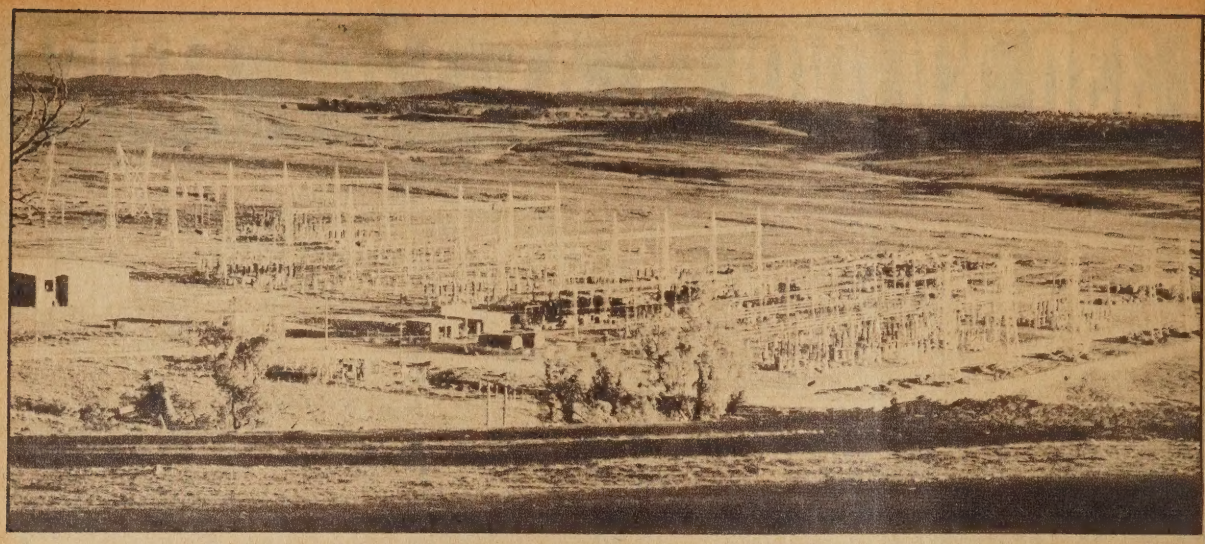


Figure 2: A 330Kv distribution centre at Yass, N.S.W. Power enters at left.

WATTS COME BY THE BILLION!

The huge towers and transmission lines which are rapidly spreading across the State are the culmination of a scheme which is giving to New South Wales one of the most advanced power reticulation schemes in the world.

By *R. W. Emerton, B.E., A.M.I.E. (Aust.)

ELECTRIC power today reaches to almost every remote part of the State of New South Wales. A casual observer travelling through our highways is impressed by the increasing number of giant steel towers straddling the countryside in huge spans, because recent tower designs are very striking in their outline and capture the attention of the most casual observer.

They are part of a family of transmission lines, which form the interconnected network of this State's electricity system.

Why does the State need an interconnected network?

Originally, power stations were built close to the larger cities and relied on extensive rail transport to obtain supplies of coal.

The Electricity Commission of New South Wales, formed in 1950, has followed the policy of building power stations adjacent to coalfields, thereby reducing greatly the cost of transporting coal.

At the same time, a source of cooling water was needed for operation of the station.

To meet both requirements, new power stations have been built at Lake Illawarra, Lake Macquarie and Wallerawang, with generating capacities in the order of 200 megawatts each. The result of the construction program to date has been to increase the total generating capacity in the State from 490 MW in the winter of 1950, to over 1,800 MW at the beginning of 1960.

This figure does not include power to be obtained from the Snowy Mountains Hydro-Electric stations, which is approximately 220 MW at present.

The policy of generating at the coalfields has been justified by lower generating costs and has been the main factor in keeping the cost of bulk energy down. The cost of transmitting power from the stations is much less than the cost of conveying coal from the coalfields to a power station, say, in Sydney.

INTERCONNECTION

The effect of having power stations widely distant from each other, and from the major load centres, has been a greatly increased need for interconnecting power lines to transmit large amounts of energy in the most efficient manner.

To meet this need the interconnected system, consisting of a backbone of 330 kV transmission lines has been planned and implemented.

A chain of steel tower transmission lines operating at 330 kV will link the terminal station of the Snowy Mountains scheme at Upper Tumut to the Commission's Distribution Centre at Yass, then proceed to Dapto near Wollongong, thence to Sydney and north towards Newcastle, Wangi, Muswellbrook and eventually to Armidale.

Some sections of this chain are already in service. The section from Tumut to Yass is currently being duplicated and other sections have been constructed and are in use at reduced voltage.

The selection of 330 kV as the major

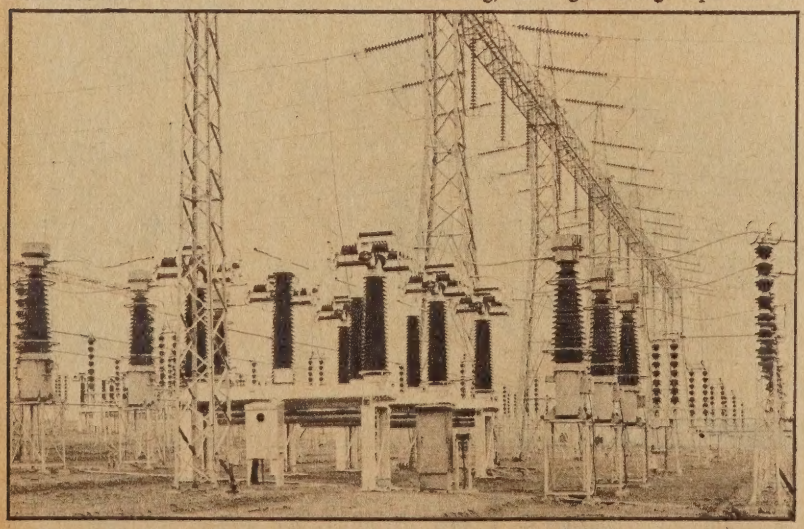


Figure 3: These air blast circuit breakers can open 330Kv at currents of up to 17,500 amps.

** Assistant Engineer/Distribution for Electricity Commission of N.S.W.*

transmission voltage was made after a great deal of investigation, by officers of the S.M.H.E.A., of current trends abroad, both in transmission lines and in the development of high voltage transformers and switchgear.

The final choice of operating voltage is usually a compromise between increased cost of equipment used at higher voltages and the savings, from reduced losses, effected by the use of higher transmission voltages.

The type of steel tower line used in the Yass-Tumut section is illustrated in figure 1 (page three). The towers average 115ft in height and carry twinned conductors of over 1in diameter in spans up to 4,000ft in length. The twin conductors will carry 1,200 amps continuously at a temperature within safe limits.

The conductors are erected so as to have a maximum working tension of 13,000lb, less than half the breaking load of 26,000lb. Each conductor consists of 54 strands of pure aluminium and a central core of seven strands of high-tensile steel which gives the composite conductor the necessary mechanical strength.

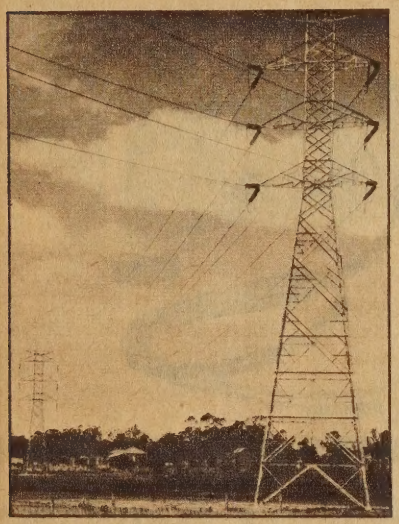


Figure 4: A typical 132Kv tower system, here carrying two circuits.

BASIS OF SYSTEM

The 330 kV backbone system is designed to feed power into major substations throughout the State where the Commission will step the voltage down for further distribution through the 132 kV network.

The first 330 kV distribution centre has been erected at Yass and is now in operation. The substation covers a vast area as can be seen from the photograph (figure 2) taken from a vantage point overlooking the valley. The 330 kV line can be seen entering the area at the left and, in front, 132 kV lines leading away from the substation. The banks of switchgear and transformers required for the operation of the substation can be seen.

The next photo (figure 3) is a closeup of a section of the switchyard and shows the 330 kV air blast circuit breakers. These circuit breakers can safely open circuits carrying fault currents of up to 17,500 amps. The large insulator bushings to the right of the circuit breakers

MAINTAINS LINE POWER FACTOR

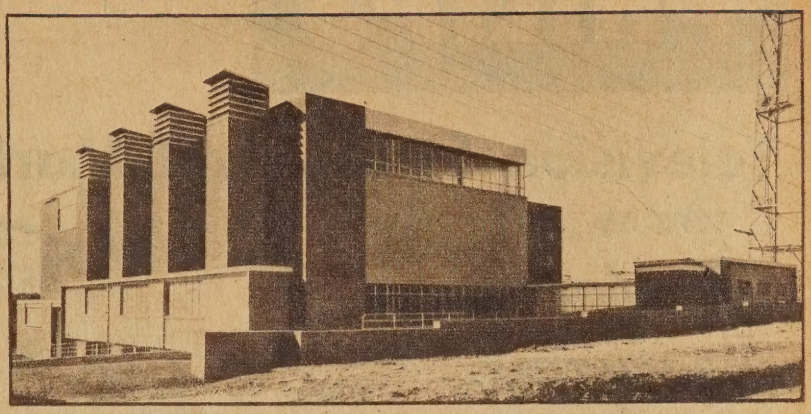


Figure 5: This imposing building is needed to house four "synchronous condensers."

are current transformers used for the operation of protection relays. Other major distribution centres of this nature will be built as the 330 kV transmission develops further.

REDUCED VOLTAGE

Having been transformed to 132 kV, the power is distributed over a wide area by 132 kV tranmission lines, which may be erected either on steel towers or on wooden pole structures. A typical section of 132 kV tower line is illustrated (figure 4). The tower in the foreground is a special strain structure used for terminations, or where severe angles in the line impose heavy loads on the tower.

The section of line shown is part of the Homebush-Tallawarra transmission line passing through the Salt Pan Creek area. Two circuits are carried on this line; each conductor of steel reinforced aluminium of approximately one inch diameter. The conductors on this line were impregnated, during the stranding process, with a special heavy bodied corrosion-inhibiting grease, since the line is subject in parts to winds from the sea which can carry salt spray.

The dumb-bell-shaped attachments near the insulators are fitted to absorb vibrations caused by wind. Vibration can very quickly cause failure at the clamps by fatigue of the metal unless effectively damped. Towers with the extended crossarms, known as a "transposition" tower, are used to transpose geometrically the position of the conductors. The effect of this is to prevent interference to communications and to maintain the electrical characteristics of the line constant over its entire length. Transpositions on this line were carried out at approximately five-mile spacings.

The 132 kV system is quite extensive and, for the purposes of reliability and continuity of supply, and to enable economic operation of the system, a large number of switching stations has been erected throughout the State. These also serve as transformation points from

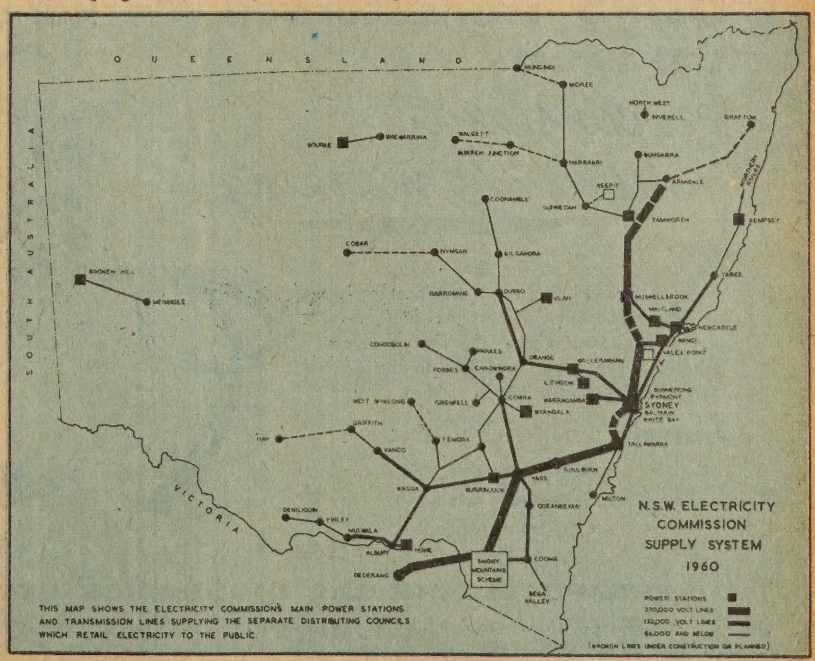

QUEENSLAND
SOUTH AUSTRALIA
VICTORIA
N.S.W. ELECTRICITY COMMISSION SUPPLY SYSTEM 1960
THIS MAP SHOWS THE ELECTRICITY COMMISSION'S MAIN POWER STATIONS AND TRANSMISSION LINES SUPPLYING THE SEPARATE DISTRIBUTING COUNCILS WHICH RETAIL ELECTRICITY TO THE PUBLIC.
POWER STATIONS
330,000 VOLT LINES
132,000 VOLT LINES
66,000 AND BELOW
(BROKEN LINES UNDER CONSTRUCTION OR PLANNED)

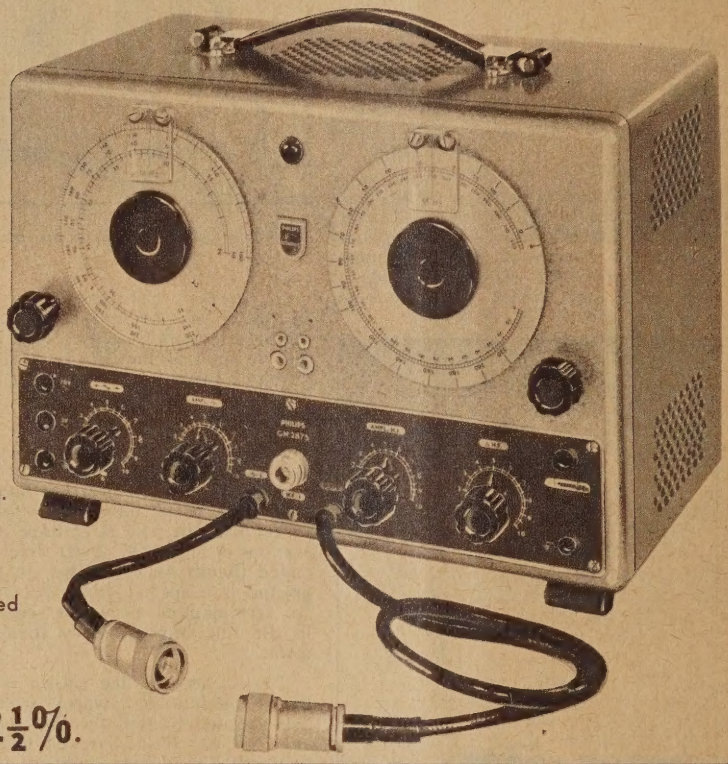
Figure 6: Electricity supply system for N.S.W.

PHILIPS

Television Sweep and Marker Generator

TYPE GM 2875

for fast accurate alignment



FEATURES

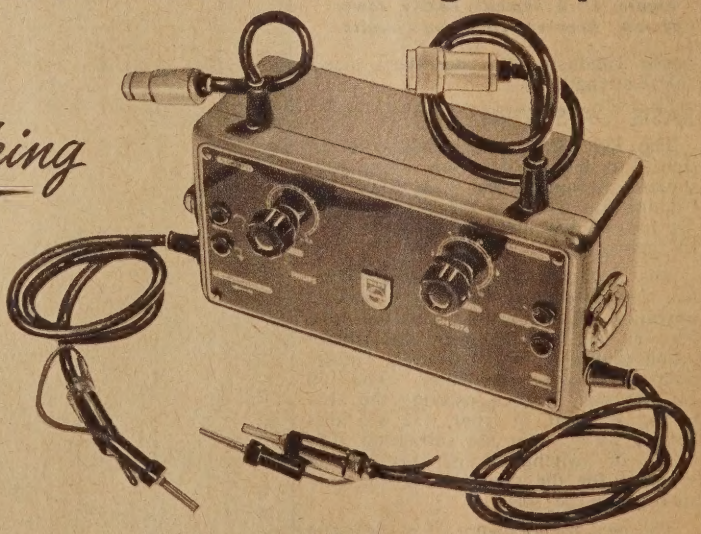
- Extremely high stability
- Frequency range from 5-220 Mc/s continuously variable.
- Internal 50 cycle frequency modulation.
- Sweep width of 0-25 Mc/s continuously variable.
- Built-in Crystal Oscillator.
- Marker Oscillator 25-55 Mc/s calibrated harmonics up to 220 Mc/s.

£120 plus S.T. 12½%.

PHILIPS Transistorised Marker Mixing Amplifier

TYPE GM 2876

for constant amplitude marking



The combination of the GM 2876 with the GM 2875 Sweep and Marker Generator permits an amplification of the frequency marker the size of which is independent of its position on the frequency response curve.

FEATURES

- Built-in variable AGC bias.
- Battery-operated.
- Fully-transistorised.

PHILIPS ELECTRICAL INDUSTRIES PTY. LIMITED

SYDNEY • MELBOURNE • BRISBANE • ADELAIDE • PERTH • HOBART

PHILIPS

P2233/60

which the sub-transmission systems of local supply authorities are supplied at voltages of 11 kV, 22 kV and 33 kV.

A typical 132 kV switching yard contains an array of airblast circuit breakers and a large number of horizontal rotary double-break isolating switches used for the isolation of feeders and for the selection of various operating circuits according to the needs of the system.

In order to increase the efficiency of transmission, it is often required to improve the power factor of a line by the connection of shunt capacitors. These are usually banks of static capacitors capable of being switched in or out of service as required.

SYNCHRONOUS CONDENSERS

At Carlingford, N.S.W., four synchronous condensers are installed for this purpose and for control of system voltage. Synchronous condensers are rotary machines, the output of which can be adjusted with fine control and which effectively supply the reactive current of the system. The dimensions of the machines are indicated by the size of the condenser house at Carlingford (figure 5) required to house the four machines and their auxiliary equipment.

Some 330 kV lines are at present being used at 132 kV. The towers have had additional crossarms fixed so that two circuits of 132 kV can be carried. At a later date these two circuits will be combined to form the standard twin conductor 330 kV circuit.

Construction of high voltage lines involves some very rugged terrain, especially on the coastal strip, and in the south-east corner of the State. River crossings pose a special problem. Because aluminium conductors are generally regarded as being adversely affected by salt water, it is necessary to haul conductors across river spans so that they are not allowed to touch the water.

The use of higher voltages also brings forward the problem of losses by corona discharge. To keep such losses as low as possible the conductors must be kept very smooth and free from scratches and burrs. Specially designed rollers and careful techniques have been evolved for the safe erection of these conductors.

ACROSS HAWKESBURY

Some idea of the spans involved in river crossings will be gained from figure 7, which shows the crossing over Hawkesbury River by a 330 kV line. Swung from points 534 and 724ft above the water, the wires still have a clearance of 300ft at the lowest point of the 4,000ft span.

Prior to World War II, 132 kV transmission was carried out mainly on wood pole lines. Wooden poles were and still are the cheapest form of structure available for most line construction. The hardwood forests of the North Coast regions produced ample supplies of good quality poles of 50-55-60ft lengths and even greater, which could be expected to have a useful life in excess of 30 years in the inland areas, rather less in the coastal regions.

Wood poles are still being used extensively for transmission line construction.

In the more rugged areas such as the coastal strip, and the south-eastern region of the State, mountainous country makes it very difficult to transport large poles, and, if erected, it would be very difficult to carry out effective maintenance.

Steel towers used in such areas need little maintenance and can be more easily transported in small sections and erected on site; due to the increased height obtainable, much longer spans can be constructed, thus reducing the number of structures required. A large number of steel tower lines has been built in the past 10 years.

However, in the extended regions of the State, i.e., west of the mountain ranges, the comparatively flat country and long distances involved make it more economical to continue the use of wooden pole lines for use at 132 kV and below. A set of standard pole structures has been adopted to meet varying needs, and these range from single poles to structures using three poles with long steel channel crossarms.

A representative single pole structure is seen in figure 8. This is a part of a 66 kV line in the Orange district, but similar structures can be seen throughout the State. The conductors in this case are of hard drawn copper strand with a steel earth wire above. Porcelain insulators are used in tension here, but the suspension string carrying the jumper past the pole on the top phase is composed of disc insulators of specially treated glass.

THREE-QUARTER MILE CROSSING

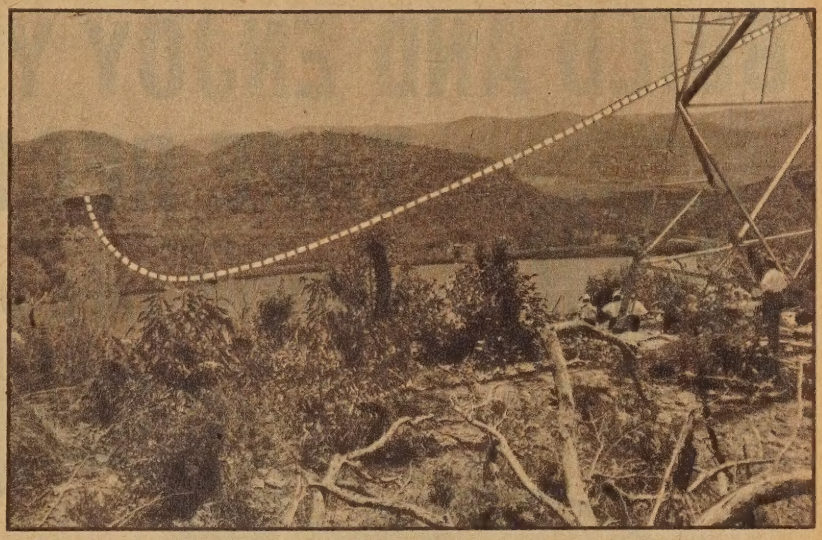


Figure 7: The three-quarters of a mile across the Hawkesbury River is equivalent to swinging power lines between Sydney Heads.

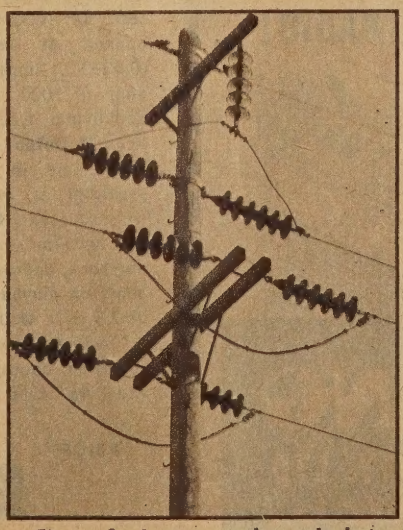


Figure 8: Just a wooden pole but it still carries 66,000 volts!

LIKELY TO SHATTER.

These have been successfully used for line insulation throughout the world but have a disadvantage due to the explosive nature of the glass. As manufactured, the discs have great internal stresses and, if subjected to impact, that is by stones or bullets, the disc will shatter completely, much like the safety glass windscreens used in modern cars. Damage due to vandalism is extremely hard to prevent, and has caused major blackouts and much unnecessary trouble and expense.

The 66 kV transmission lines were extensively used in the past. However, as loads grow, it has been necessary to replace them with lines operating at higher voltages for lines carrying main supplies. In 1950 the main interconnector between Sydney and Port Kembla was a single circuit 66 kV line.

It was superseded by a double circuit 132 kV line in 1951 to bring power to Sydney from Tallawarra and at present work is progressing on the erection of a 330 kV transmission line over the same general route. A number of 66 kV transmission lines are being built where load conditions are not very heavy and where long distances require the use of a high voltage to prevent excessive losses.

A typical example is the line from Nyngan to Cobar which is nearing completion at present. The length of this line is approximately 80 miles and will supply the proposed new Cobar Substation from the interconnected system. The substation will step down power from 66 kV to 11 kV for distribution in the Cobar district.

(Continued on Page 127)

Now! at reasonable cost, you can

BUILD AND ENJOY YOUR OWN TAPE RECORDER!

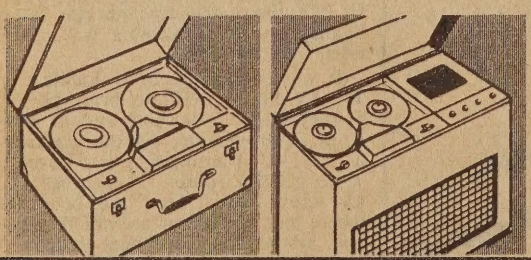
BSR

with the ALL-NEW

MAGNETIC TAPE DECK

MODEL TD1

BUILD IT AS A PORTABLE OR BUILD IT INTO A RADIO!



SPECIFICATIONS

● **Tape speed,** 3¾ second ● **Size of reels,** 5¾" diameter (1200 ft. of tape) ● **Heads,** half track ● **Tracking,** top track, left to right (International Standard) ● **Playing Time,** 2 hours (1 hour per track) ● **Re-wind time,** 3 mins. 50 secs. for 1200 ft. ● **Fast-forward time,** 3 mins. 50 secs. for 1200 ft. ● **Brakes,** spring loaded, differentially applied ● **Record/playback head,** narrow-gap type (0.0002"). Impedances: 2800 ohms at 1000 c/s. 2300 ohms at 5000 c/s. 5800 ohms at 50 Kc/s ● **Erase head,** double-gap type (0.005"). Impedance: 140 ohms at 50 Kc/s ● **Output on playback,** approx. 30 mv. for average programme ● **Recommended frequency of supersonic oscillator,** 50 Kc/s ● **Power required for full erase,** 0.4 watt (approx.) ● **Supersonic voltage level for recording,** bias level/maximum signal level = 250/1 ● **Bass boost on playback,** approx. 30 db between 50 and 100 c/s ● **Treble boost on playback,** start at 3 Kc/s, rising to 20 db boost at 7.5 Kc/s ● **Overall response obtainable,** 30 to 8000 c/s + 3 db ● **Wow and Flutter,** 0.4% r.m.s. ● **Power consumption,** approx. 10 watts. ● **Dimensions,** 13" long, 8¾" wide, 4½" deep ● **Weight,** 6 lbs. 8 ozs.

PRICE:

£30-0-0

See this BSR Tape Recorder at your retailer's today!

GOLDRING

ENGINEERING (AUST.) PTY. LTD.

449 Kent St. Sydney. Phone BX1275/6

COMPLETE TV SYSTEM IN SPACE

The United States "weather" satellite, "Tiros," constitutes what is probably the most elaborate electronics package yet sent into orbit around the earth. It contains specially-designed miniature television cameras, video tape recorders, transmitters, solar cell and rechargeable battery power supplies and an array of control and communications equipment.

SPEEDING along its course in space, the satellite is linked to an extensive ground network of tracking and receiving stations, data-processing systems, and programming and control centres. Together, the satellite and ground equipment form a unified system to gather and analyse world-wide data on cloud formation in the earth's atmosphere.

The TIROS system, including the satellite and its associated ground network, was designed and constructed by scientists and engineers of RCA's Astro-Electronic Products Division at Princeton, N.J., under the general systems management of the National Aeronautics and Space Administration and the technical direction of the U.S. Army Signal Research and Development Laboratory at Fort Monmouth, N.J.

ORIGINAL CONCEPT

It evolved from the original concept of Vanguard II, a weather satellite developed by the Army Signal Corps for NASA.

Dr Elmer W. Engstrom, Senior Executive Vice President of RCA, has described the system today as "a major achievement in space technology."

The importance of the TIROS system as a new experimental tool for meteorologists was emphasised by Barton Kreuzer, Manager, Marketing, of the RCA Astro-Electronic Products Division, who said:

"The mission of the TIROS satellite is the visual observation of cloud formations over large portions of the earth to produce new information about such weather phenomena as hurricanes, typhoons, and the movement of weather fronts.

ACCURATE DATA

"Besides providing unprecedented and comprehensive visual coverage of global weather on a swift and continuous basis, the satellite will give meteorologists for the first time a means of checking the accuracy of present weather reporting from ground stations around the world.

"Thus it promises not only to lay the groundwork for new satellite weather services in the future, but also to increase the effectiveness of present world-wide weather information gathering methods."

The path of the satellite, circling the globe from west to east about every 90 minutes at an altitude of about 400 miles, will permit cloud observations throughout a belt extending from the latitude of Santa Cruz, Argentina, in the south, to the latitude of Montreal, Canada, in the north.

During its planned operating lifetime of 90 days, the satellite is expected to complete about 1,300 orbits, covering every part of this belt many times.

According to Sidney Sternberg, Chief Engineer of the RCA Astro-Electronic Products Division, the operation of the system involves the following sequence of three principal functions carried out by an intricate combination of electronic sub-systems in the satellite and on the ground:

(1) Preparation of a program and transmission of commands to the satellite at the start of each orbit, including instructions for picture-taking in specific areas of interest to the meteorologists.

(2) Operation of the television and other equipment in the satellite to the control commands received from the ground.

(3) Read-out of the pictures and other information from the satellite on command from the ground at the completion of each orbit.

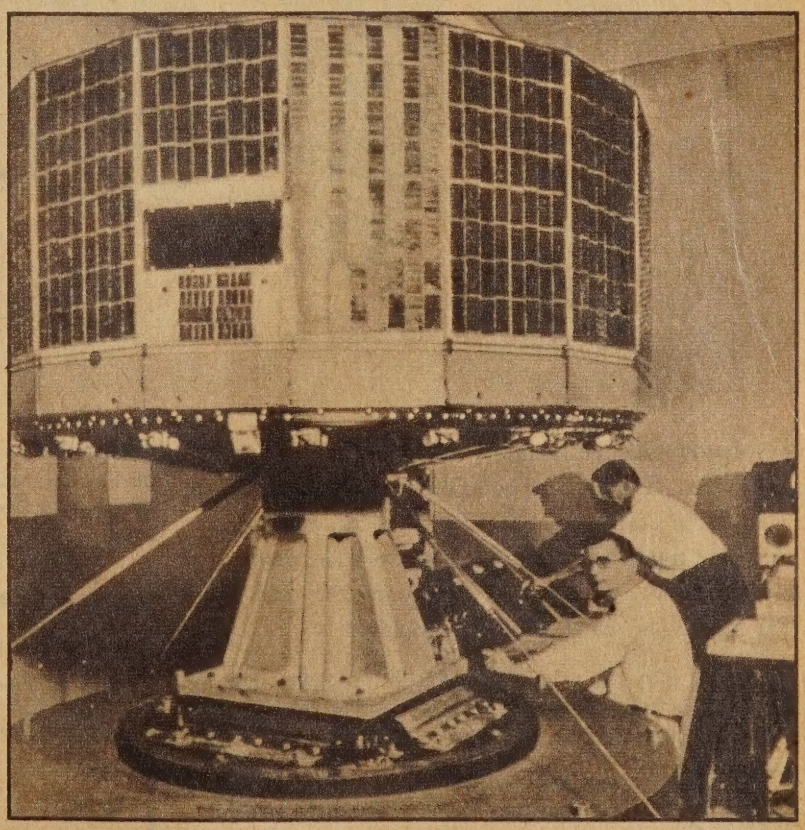
The principal ground stations are situated at Kaena Point, Hawaii, and Fort Monmouth, N.J. During all but three or four orbits each day, the satellite passes within range of one of the stations, permitting readout of information and programming of the satellite electronic apparatus for the next passage.

In addition, two "backup" stations are situated at the Space Centre of RCA's Astro-Electronic Products Division at Princeton, and at Cape Canaveral, Florida.

MAJOR ACHIEVEMENT

The satellite itself was described by Mr Sternberg as "a major space system complex" incorporating advanced concepts in space communications and the remote control of satellite functions.

He pointed out that its development had required not only the design of new miniaturised television equipment and methods of controlling the satellite's rate of spin, its attitude in relation to the earth's surface, and its thermal balance during the 90-day period.



A close-up picture of "Tiros" undergoing vibration tests at the RCA laboratories in Princeton, N.J. Since passing into orbit, it has sent back numerous pictures.

Post coupon today for this important book on Transistors

Every student in the radio and electrical industry should send for this authoritative book on transistors and other semiconductor devices. Published by Mullard, world leaders in valve and transistor research, it provides a comprehensive non-mathematical treatment of semiconductors and some of the devices in which they are employed . . .

CONTENTS INCLUDE:

Discussions on Germanium . . . The Transistor . . . and other Semiconductor Devices

24 pages . . . 30 skilfully executed illustrations, many in colour

MULLARD-AUSTRALIA PTY. LTD.
35-43 CLARENCE STREET, SYDNEY, BX 2006; 123-129 VICTORIA PDE., COLLINGWOOD, N.5. VICTORIA, 41 6644.

Mullard

ASSOCIATED WITH MULLARD LIMITED, LONDON, MULLARD EQUIPMENT LIMITED AND MULLARD OVERSEAS LIMITED

Mullard-Australia Pty. Ltd., Box 2118 G.P.O. SYDNEY

Please send me ..... copies of "A Simple Explanation of Semiconductor Devices", for which I enclose ..... remittance, being 5/3 per copy plus 5d. postage.

NAME.....

ADDRESS.....

.....STATE.....

MT90

He gave the following summary of its principal features:

Shaped like a drum, 42 inches in diameter and 19 inches in depth, the vehicle is covered on its top and sides with over 9,000 solar cells which generate electricity directly from sunlight to charge an assembly of small storage batteries that power the electronic equipment.

The key function of the satellite is performed by two complete television systems capable of taking a series of still pictures of cloud formations during each orbit.

Each employs a specially-developed RCA half-inch Vidicon camera, small enough to hold in the palm of a hand. One of the cameras is equipped with a wide-angle lens for viewing clouds in an area about 800 miles on each side. The other employs a narrow-angle lens to scan cloud details in a smaller area.

VIDEO RECORDER

Linked to each camera is a miniature television magnetic tape recorder specially designed for satellite use. Each of the recorders stores up to 32 individual pictures taken by the camera during a single orbit.

When the satellite passes within range of one of the ground stations, a command signal causes the information to be read from the tape into the satellite transmitter for transmission to the earth.

For picture-taking while the satellite is within range of the station, the cameras can be instructed to feed their information directly to the transmitter rather than to the tape storage systems.

To permit meteorologists to identify the direction of each picture, the satellite carries a "north indicator" system which automatically measures the angle of the sun in relation to the vehicle. The resulting signal, sent to the ground with each picture, is processed by a "sun angle computer" and displayed on a television screen beside the picture to indicate the north direction of the image.

In addition, an infra-red detector on the satellite senses the crossing of the earth's horizons as the vehicle rotates at its spin rate of 12 revolutions per minute. This information also is transmitted to the ground and is processed to determine the attitude in space of the vehicle at the time of picture taking.

SPECIFIC AREAS

At the start of each orbit, the television cameras can be instructed electronically to photograph an area of specific interest—such as a typhoon centre over the Pacific or a hurricane in mid-Atlantic.

The instructions, prepared at the NASA Computing Centre in Washington, in co-operation with specialists of the United States Weather Bureau, are sent to the ground stations. At the appropriate station, the program is sent in the form of radio signals to an "electronic clock" in the satellite.

The clock stores the instructions somewhat in the fashion of a remotely operated alarm clock, causing the cameras to start a sequence of operations at the specified time during the succeeding orbit, as the satellite passes over the region of particular interest.

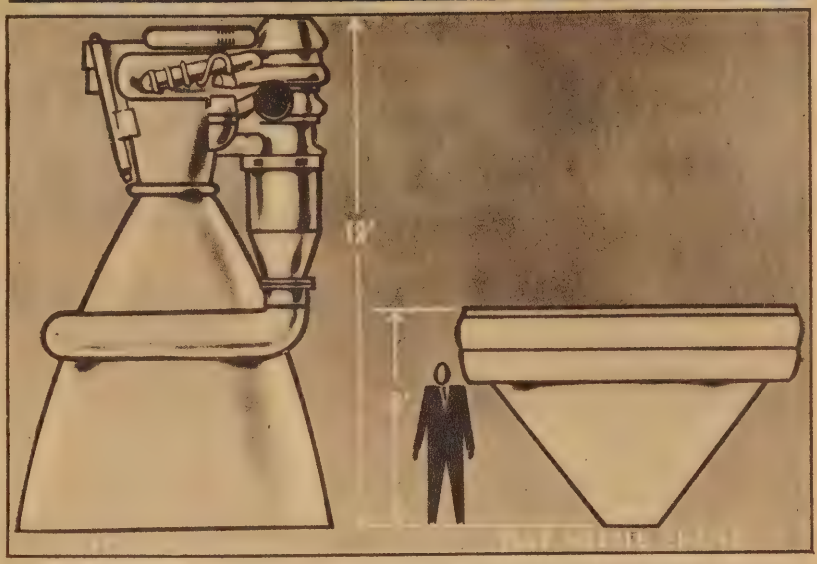
As the satellite swings around the earth and comes again within range of a ground station, a command signal is sent from the ground for transmission of the cloud cover pictures stored on the tape.

At the ground station, the information is displayed on a television picture tube and recorded on another magnetic tape system. The image on the picture tube also is photographed for further study and future reference by experts of the Weather Bureau and other services. Mr Sternberg pointed out that the ground command and control system has been designed by RCA engineers to permit either automatic or manual operation of the satellite system, or a combination of both.

With automatic operation, the program for the orbit is pre-set and each step is started by the electronic clock control in the satellite. With manual operation, the commands are transmitted by an array of push-buttons at the ground station, permitting direct operation of the television cameras while the satellite is within range, and providing an opportunity for checking individual satellite functions.

By combining the two methods, the program is pre-set, but each sequence is started manually by push-buttons at the ground station when the satellite is within range.

NEW ROCKET ENGINE CONCEPT



DETAILS of a radical new concept in rocket engine design have been disclosed by the General Electric Company (U.S.A.). The concept, which promises important advantages for future missiles and space vehicles, is that of the "plug nozzle" engine.

The plug nozzle differs in several respects from the conventional rocket engine. In the latter, combustion of fuel and expansion of exhaust gases occur inside a large bell-shaped chamber, while the plug nozzle engine has a ring of relatively small combustion chambers arranged as a unit about the base of a protruding conical "plug," along which the exhaust flows in direct contact with the atmosphere.

This external expansion of the gases is the key to one of the advantages expected of the new engine, inasmuch as it results in the natural adjustment of the exhaust flow to the pressure of the surrounding atmosphere, thereby increasing the engine's efficiency, especially at lower altitudes. For this reason, the plug nozzle would be particularly effective in the initial or booster stage of a multi-stage rocket.

The engine's primary advantage, however, according to a General Electric spokesman, would be its adaptability to varying requirements, which would enable it to be readily and inexpensively sealed to multi-million-pound thrust levels.

Because testing of conventional single-chamber rocket engines can be satisfactorily accomplished only with full-scale models, their development is often long and costly.

In contrast, the annular combustor of the plug nozzle engine is made up of a number of small cells which can be tested individually without difficulty and assembled to produce the desired thrust level.

A further advantage of multiple-cell construction would be the possibility of aerodynamic correction of the rocket's trajectory during flight by control of the combustion pressure in the various cells. This would eliminate the need for gimballing mechanisms and would permit rigid mounting of the engine directly to the frame of the vehicle. The space and weight savings thus achieved, together with the general compactness of the plug nozzle engine, which is expected to be only half the length of a conventional engine of similar power, would considerably increase the rocket's payload capacity.

GRUNDIG CLOSED-CIRCUIT TELEVISION

FIELDS OF APPLICATION

In all branches of industry for centralised supervision and observation, for co-ordination, for the transmission of construction proposals, for the control of gates, buildings, and equipment, for the supervision of individual stages on an assembly line, for transferring diagrams and measurement data, for the thousand-and one jobs to save time, money and life.

Mining

In mining for the observation of drilling in difficult situations, for the control of catches on hoppers, for the inspection of mining cages, for the monitoring of the conveyor runoff, for the supervision of deep-well drilling, and for increasing the field of view of a steam shovel operator in open-pit mining.

Power

In power plants for the relaying of the water level, for the observation of the ignition process and the burner operation in the firebox, for the observation of the cinder flow, for the control of oil burners, and for the study of smoke streams.

Medical

In hospitals, for the training of nurses and students, to enable standby surgeons to take over a difficult operation, for medical and cancer research developments.

Heavy Industry

In the iron and steel industries for the observation of blast-furnace charging, for the supervision of the smelting process in the blast-furnaces, for the observation of the tapping of blast furnaces, for the control of the runoff of steel from smelting furnaces during casting operations, and for the supervision of long rolling trains.

Chemistry

In the chemical industry for the observation of experiments with poisonous gases and for the supervision of experiments using high pressures and high temperatures. In the explosive industries for the supervision of kneading mills and screening as well as for the observation of the disarming of bombs or their demolition, and for the safe supervision of automatic manufacturing procedures.

Photography

For professional photographers, for composing difficult shots and pre-viewing lighting technique.

Transport

In loading operations for the direction of cranes, steam shovels, and other equipment, when the operator's vision is hampered, for the observation of loading and unloading procedures, for the distant observation of the flow of material on conveyor systems and its subsequent control, and for the supervision of automatic filling machines.

Safety

In railroad networks for the surveillance of railroad yards, for the observation of car movement, for the control and recording of car numbers, for the inspection of freight cars for damaged axles or springs. By the police for a more detailed observation of the traffic and its subsequent control.

Banking

In banks for the examination of the signature on cheques, for the transmission of accounts, for the distant observation of the cashiers and the public.

Science-Electronics

In science and research, the combination of the television camera with the microscope produces the so-called tele-microscope. This permits the observation of the microscope image on the television screen by larger audiences. The use of special television pickup tubes sensitive to infra-red makes possible microscopic examinations without staining. The resolution of the optical image into individual electrical signals when used together with counting devices; results in quantitative microscopy. In medicine for the transmission of operations, so that students can follow the methods of the surgeon exactly and thus receive their training better and faster than was previously possible, for the diagnosis of eye disorders whereby the Tele-Eye works together with an ophthalmoscope. The diagnosis in gynaecolgy is facilitated by the tele-colposcope.

This outline has no claims to being complete; it should simply serve to give an idea of the multitudinous possibilities which are offered by the utilisation of television in the most diverse areas of human endeavour.

"Sole Victorian Distributors"

UNITED ELECTRONICS (A/SIA) PTY. LTD.

31-33 CAMBERWELL ROAD, CAMBERWELL JUNCTION

Temporary Phone 82-5688

An Auto Engine Without Pistons

A German Company making motor cycles, scooters and Prinz cars has startled the auto world with an entirely new type of internal combustion engine. Instead of pistons that shuttle up and down, it uses a tricky three-lobed rotor.

By David Scott

A CROSS between the ordinary internal-combustion engine and the turbine, it promises twice the power from the same weight and size as conventional engines.

Besides that, it's quiet and almost vibrationless. What's more, it is cheap to make, economical to run and simple to maintain. It has only two main moving parts.

This potent package is a rotary gasoline engine, an engineering will-o'-the-wisp that has eluded inventors for generations.

It has apparently been captured at last by the NSU Werke, of Neckarsulm, Germany, makers of motor cycles, scooters, and Prinz cars. Experimental engines are already at work driving pumps. Others will power the Prinz, perhaps by 1961.

The engine also looks like a hot possibility, in small sizes, for lawnmowers, outboards, chain saws and motorbikes. Even powered roller skates may not be ridiculous. Bigger models, perhaps with rotors set in tandem, could power large cars, trucks, boats and planes.

In the U.S., Curtiss-Wright has the rights to build versions of 100 h.p. and up.

In one sense the engine does have pistons, pushed by a burning gas-air mix as in conventional gasoline engines. But the piston goes round and round, like the rotor of a turbine.

The rotor is roughly triangular. It turns eccentrically inside a wasp-waisted combustion chamber, its three apexes always touching the walls. This creates three moving cavities inside the combustion chamber.

The three cavities constantly change size, so that the rotor first draws in fuel, compresses it, then lets it expand after ignition, and finally exhausts. The operation is standard four-cycle, although there are three power "strokes" for each revolution.

The radical design brings astonishing performance. Here's what you get:

Concentrated power: High ratio of horsepower to displacement. NSU's first experimental engine (not the latest design) developed a phenomenal 3.8 horsepower per cubic inch. The best U.S. stock-car engine gets just over one.

WOULD PRODUCE 1000 HP!

If you indulge in arithmetical juggling, as publicity men do, you'd find that a rotary engine the size of the "mill" in the 1960 Ford should blast more than 1,000 horse-power! Such theoretical scaling-up, however, is not likely to work out.

Very light weight: That first engine contained 1.3 pounds of metal for every horsepower it produced and a pounds-to-power ratio of .83 is possible. Since the saving is in dead weight, you could manage the same load with a less powerful—and still lighter—engine.

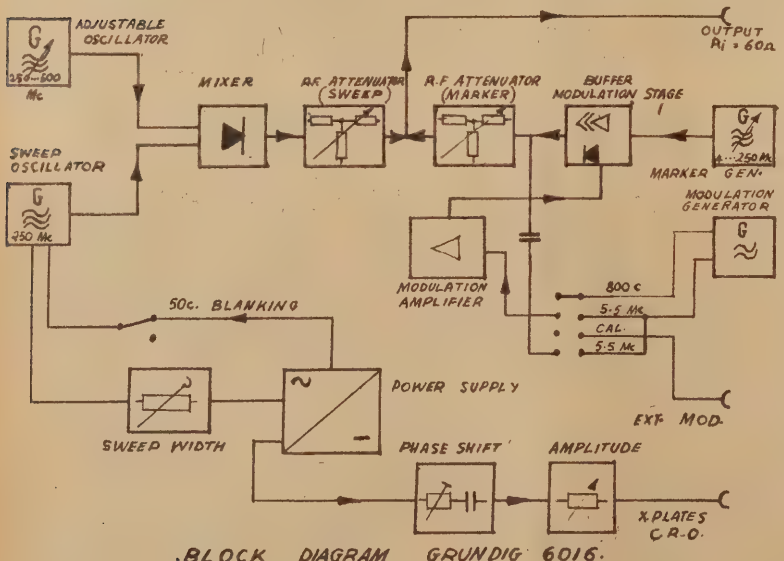
***HOW IT WORKS:** You can follow one lobe of the triangular rotor (shaded edge) through a complete Otto cycle of intake, compression, ignition, and exhaust by reading the color legends on the sequence drawings below. The black legends tell what the other lobes are doing meanwhile. In operation, one lobe follows so closely on the other that firing is almost continuous. Power is taken off by the internal gear and a mating one on the output shaft, which together provide the eccentric action. If you can't believe that this odd-ball rotor-chamber combination will make separate spaces of changing volume, trace the rotor on tissue paper and rotate it eccentrically clockwise over one of the drawings. It really does work.*

Available now from

JACOBY, MITCHELL

GRUNDIG
6016
TV Sweep and Marker Generator

- Marker frequency on fundamentals.
- Self checking marker facilities.
- Calibrated attenuators.
- Provision for external marker modulation.
- Sweep width continuously variable to 30 Mcs.



BLOCK DIAGRAM GRUNDIG 6016.

Available from all distributors.

SYDNEY PRICE £187/15/- plus sales tax.

Other States slightly higher.

(Ask for our special leaflet showing all TV test equipment.)

SPECIFICATIONS:

SWEEP GENERATOR

Frequency Range: 4-250 Mc/s. in one range.

Sweep Width: Continuously adjustable in 6 coarse steps with fine control on each range 1-30 Mc/s.

Sweep Repetition Rate: 50 cps.

Sweep Output Voltage: 0/100V pk.-pk.

R.F. Output Voltage: 10uV to approximately 50 mV.

Output Impedance: 60 ohms.

MARKER GENERATOR

Frequency Range: 4-250 Mc/s. in 6 switched ranges.

R.F. Output Voltage: 10uV, to approximately 50 mV.

Output Impedance: 60 ohms.

Modulation Switch Positions:

Pos. 1—off.

Pos. 2—Calibration check between the internal 5.5 Mc/s. oscillator fundamental frequency or harmonic thereof and the marker frequency in use.

Pos. 3—External AM from video frequency source.

Pos. 4—5.5 Mc/s. AM from internal oscillator.

Pos. 5—800 c/s AM from internal oscillator.

GENERAL

Consumption: Approx. 55 watts.

Dimensions: 42 x 30 x 21 cms.

Weight: 15 kg.

Accessories: Type 6028. 300 ohm. "Balun."

Type 6046A. Terminated output lead.

Type 6043. Injection unit and pad.

Valves: 3 x EC81, ECF80, EC92, 150C2, 150B2.
2 x DS159, OA85.

Input Volts: 110/220V, 40 . . . 60 cps.

JACOBY, MITCHELL and Co. Pty. Ltd.

469-475 KENT STREET, SYDNEY. MA8411.

BRANCHES—

MELBOURNE: 113 Bridge Road, Richmond (JB5100)

NEWCASTLE: 135 Beaumont St., Hamilton (MA4744)

Low cost: Despite the exotic shape and fancy sealing, which the combustion chamber demands, NSU claims the engine is easy to mass-produce. The moving parts are simple enough—a triangular rotor and a straight output shaft.

Economy: The rotary daintily sips fuel, consuming less than an ordinary auto engine, a little more than a diesel. For lubricating, you just add a dash of oil to the gas (2¼ ounces per gallon).

But the astonishing thing is the kind of gas. This engine uncomplainingly swallows fuel so crude it would gag a bus, even accepts such prehistoric stuff as 43 octane. Yet the compression ratio is high: between 7.5 and 8.5:1.

The impressive resistance to knocking is basic to the design:—Intake is on one side, exhaust on the other. That means incoming fuel finds no hot spots (like the exhaust valve in an ordinary engine) waiting to detonate it.

Little vibration:—The clank-bang-shake of reciprocating machinery is pleasantly absent, although turbine smoothness is not quite achieved. There's a counter-weight and the off-centre rotor to wiggle. But gentle operation should cut first costs — mounting is less critical — as well as upkeep expenses.

LESS NOISY

Quiet:—Rotating machines make less noise to start with and this one also gets along without valves, which are to blame for most of an ordinary engine's roar. NSU's rotor quietly uncovers ports, and the only sound you hear is a discreet whir-r-r.

Responsiveness:—You get most power at high r.p.m., naturally, but substantial output at low speeds — the torque curve is relatively flat. This means you'll take hills and turn corners with less down-shifting and you might get along with a simpler transmission.

However, before you rush out and tie knots in the crankshaft of your old V8, consider the problems. There are some.

Sealing:—The combustion spaces formed by the rotor must be separate and gas-tight against an average pressure of 121 p.s.i. The apexes of the rotor carry sealing lips that wipe against the chamber wall. But how the sides of the rotor are sealed is not entirely clear.

There are three bars, spring-loaded, projecting out from each side of the rotor. They run approximately from one apex to another, presumably parallel to the edges of the rotor, NSU does say that sealing is still a major problem.

Cooling:—The combustion chamber has a water jacket, like an ordinary cylinder. The rotor must be cooled mainly by incoming fuel, which always enters on the side away from the combustion area.

Size limitations:—Some outside engineers suspect that big versions won't equal the amazing performance of the very small (7.6-cubic-inch-displacement) prototype.

Adaptability:—NSU admits to worries about meeting the variable demands of autos, ships and planes. Running pumps, which present a steady load, is easy.

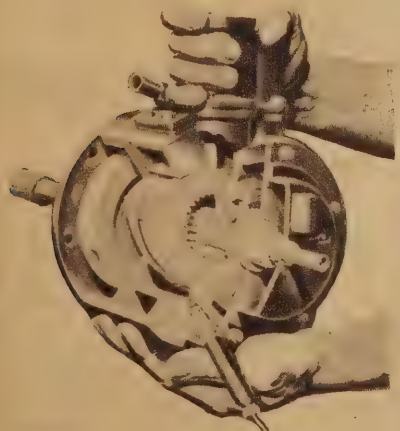
How serious these problems are may not be known for several years of further development work. The fact is that rotary combustion engines have been built, and they work. This alone is a notable achievement, as NSU immodestly proclaims.

Most of the rotary engine's advantages come simply from the fact that it is rotary. Right off that knocks out much of the noise, vibration, and complex gimcrackery that plague reciprocating engines. It also side-steps a difficulty that hobbles power.

Reciprocating pistons must be brought to a dead stop at each end of their travel, then accelerated in the opposite direction. It takes energy to stop them and to speed them up again. The stopping energy must be absorbed in the machinery — a great strain on bearings. The speeding-up energy is a drain on engine power — it never gets to the wheels.

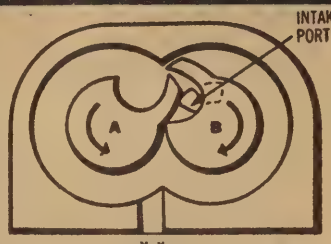
Worst of all, these intertia losses increase in proportion to the square of engine speed. That's why reciprocating

(Continued from Page 21)

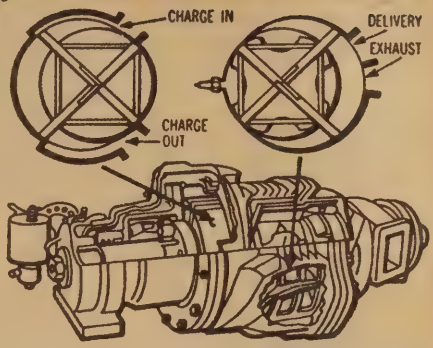


***POWER FOR THE PRINZ:** Rotary engine is meant for NSU's small car, now powered by a two-cylinder OHV. Experimental rotary with one-fifth the displacement—7.6 cu. in. against OHV's 35 cu.in.—outpunches it, 29 h.p. to 26.*

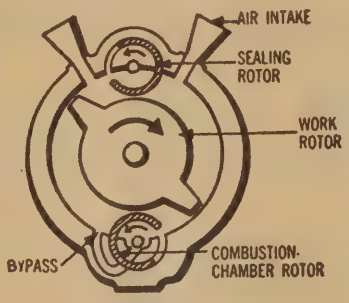
IDEAS THAT DIDN'T WORK OUT



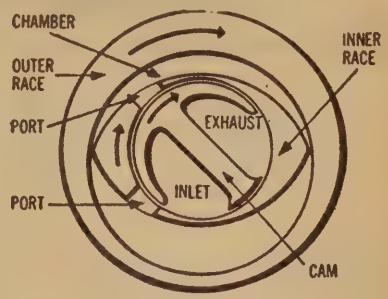
TWO-ROTOR ENGINE with interlocking fingers was invented in 1932 by an Australian. One experimental model was reported to have delivered 12 h.p. In the position shown, a charge of fuel entered until rotation of B closed the intake port. Exhausts were apparently at x-x on the drawing. The rotors had to seal against each other.



SLIDING VANES sealed tandem rotors in Danish Larsen engine of 1935. First rotor (top left) took in fuel, delivered it to work rotor behind it, which compressed, fired and exhausted charge. Lower drawing shows complete engine.



BAYLIN ENGINE, a Canadian invention, won much attention. It had fuel injection, and made two working strokes per revolution. Small rotors sealed off intake and expansion chambers. Intake air was forced into combustion chamber rotor. Fuel was injected and ignited as lobe of work rotor meshed with combustion rotor. High performance — one horsepower from 1.1lb of weight—was claimed.



EARLY VERSION OF NSU ENGINE, since abandoned by its designers, was a nightmare of spinning pieces. The outer race turned four times and the inner race twice for each revolution of the anchor-shaped valve cam. Chamber volume changed as the oval inner race swept around the eccentric cavity, while the valve cam successively uncovered ports to the two combustion chambers for intake and exhaust.

This picture shows the cohesive effects of tree roots and also how much soil has been simply blown away.

Trees Hold Water, Prevent Erosion

Trees have been regarded by many as a natural encumbrance on good building and farming land. Too late, in many cases, has it been realised that they are vital to the preservation of soil, water and fertility.

by Calvin Walters

WHEN one travels the highway, through vast forests, there is little visible evidence, apart from a sign or two, that any organisation is taking place within the great belts of ordinary trees.

We do, of course, see large pine forests and we know that these Monterey Pines are not a native of our country. We know that these at least have been planted into vast artificial forests.

There are other forests, however, which are now controlled by the Forestry Commissions of the various States. Controlled so that there will be no more indiscriminate plundering of trees by exploiters, with consequent destruction of the land and depletion of water supplies.

N.S.W. FIGURES

In New South Wales with an area of 198,000,000 acres, there is a grand total of forest area of 13,180,000 acres or 6.6 per cent of the total area. Of this 6,302.000 acres are Government controlled State Forests. The balance of forest area consists of dedicated timber reserves, forest on private property and areas of forest on Crown lands.

We have controlled forests on our North Coast of Tallowwood, Blue Gum, Blackbutt, Spotted Gum and Ironbark. On the South Coast there are vast forests of Spotted Gum, whilst the rest of the Coastal area forests are of mixed types such as Coachwood, Hoop Pine, Red Mahogany, Box, and so on.

On the highlands there are forests of Alpine Ash, Yellow Box, and many others whilst, generally speaking, our forests somewhere or other contain such valuable timbers as Flooded Gum, River Red Gum, Brush Box, Turpentine, White Beech, Red Cedar, White Cypress Pine, Slash Pine and many others.

Throughout these forests, Forest Managers are at work planning, cleaning, organising, cutting and replanting in accordance with a national policy of timber conservation.

The now universal science of Forest Management has taken the place of the exploiter. Our land resources depend on the Forest Managers, as do to a large extent our water supplies, as will be seen.

The science of Forest Management takes many matters into account. It provides access roads through the forest. It cultivates the forest areas, removes old and diseased trees, thins out unwanted undergrowth, plans the proper cutting and removal of good trees and plants new trees to replace those removed.

The best trees for a given area are planted, while weeds and insect and bacteriological pests are controlled. Fire prevention is organised and modern methods of timber transport used.

There are physical and chemical laboratories for research into improved methods of cultivation and new utilisation of wood products.

TYPICAL ACTIVITIES

Re-aforestation is encouraged by thinning of overdense young stands, by the encouragement of natural seeding through retention of seed trees in felled areas and by the planting of seedlings in cases where species other than those naturally occuring are desired such as Monterey Pine, Douglas Fir and Rose Gum, all exotic trees.

Research is also conducted into the greater and more complete utilisation of each log, such as better methods of cutting and the use of poorer quality material for hardboard manufacture.

This, then, is what our Forestry Commissions do for us in a way little realised by the general public. Why they do this and how it helps us will be seen as a matter not only of conservation of timber but other factors as well.

The maintenance of timber reserves is a vital part of any nation's economy. Continual cutting down of trees without the planting and protection of new ones is as insane economically as the failure to conserve water.

Most people, no doubt, look upon a forest as something to give shade for their comfort on summer picnics. They go to the forest to fish in the streams of water, to hunt the wild fowl and animal life.

Or perhaps they think of the forest as a protection for koalas, wallabies and other native animals which they like to observe and admire.

TIMBER, PAPER

A forest is much more than this. It is the place from which we derive all the timber we need for the many different structures we build. It is the source of all the beautiful timber we use for furniture and ornamental panels.

From the forest we get pulp for paper making, so that millions of books per year can be printed and millions of newspapers per day can be read. Cellulose, derived from wood, is used as a base for over ten thousand chemicals.

Then, of course, we get fuel from the forest and all kinds of berries, nuts and so forth.

In addition to all this, the forest protects the land from erosion, helps to control floods and has an influence on climate.

The greatest enemy of the forest is

FROM SEED BOX TO PLANTATION

man. Over the centuries he has pillaged the forest by cutting and burning and neglecting. In many cases his destruction has rendered vast tracts of land unusable by encouraging too much run-off of water. This has resulted in the washing away of vast areas of topsoil, thus destroying the land and filling rivers and creeks with silt.

It has, in turn, lowered the capacity of rivers and creeks to carry water, with the result that floods now devastate land which would otherwise be free of them.

Scientists believe that most of the earth was covered with forest in prehistoric times, except the poles, barren mountains and certain deserts.

During those times the forests only fluctuated according to the inroads of glacial periods. They shrunk during those periods and recovered as the glaciers receded and warmer weather appeared again.

LOSS OF AREA

Under the influence of man however, the forests have continually receded. As he multiplied he needed more room to spread. He needed building material and food and space for farms and cattle.

The forests were an encumbrance to him in this respect for, while there were forests ample enough to supply his needs, vacant space was at a premium. Thus, as civilisation spread, the forests were destroyed.

Much the same goes on today. The trend of people to move toward areas of greater population has, in turn, brought the land exploiter into the picture. Vast areas of forest are being cleared and the land sold by profit-hungry exploiters to land-hungry people.

There are certain interesting fundamental relations between the forest and the water supply, without an understanding of which it is not possible to realise the tremendous importance of the forest to soil erosion and the flow of streams.

Let us look at an area which is devoid of trees. When rain-water falls on such land, it begins to run downhill in a thin sheet. Without grass or trees to hold the soil the water washes away the topsoil in a fashion called sheet erosion.

BINDS SOIL

When a tree seed germinates it begins to send out tiny rootlets which branch out horizontally in search for food and water. These roots in turn branch out again. They curve around rocks and find their way between layers of rock and shale, binding everything into a solid mass which holds the soil in a firm grip.

One solitary tree standing midst an eroded hillside will be testimony enough for those who observe the soil held within the tentacles of its exposed roots.

It is by such studies that the forester has finally brought other branches of science to his aid in understanding how the forest affects our water supply.

The forester has enlisted the aid of such sciences as biology, physics, chemistry, meteorology, geology, soil science, and bacteriology to help unravel the mysteries of the forest.

When rain or snow falls upon the trees in a forest, much of the fall is intercepted by the leaves and branch formations. A certain amount of this water evaporates without reaching the ground and the remainder runs down the branches and trunk.

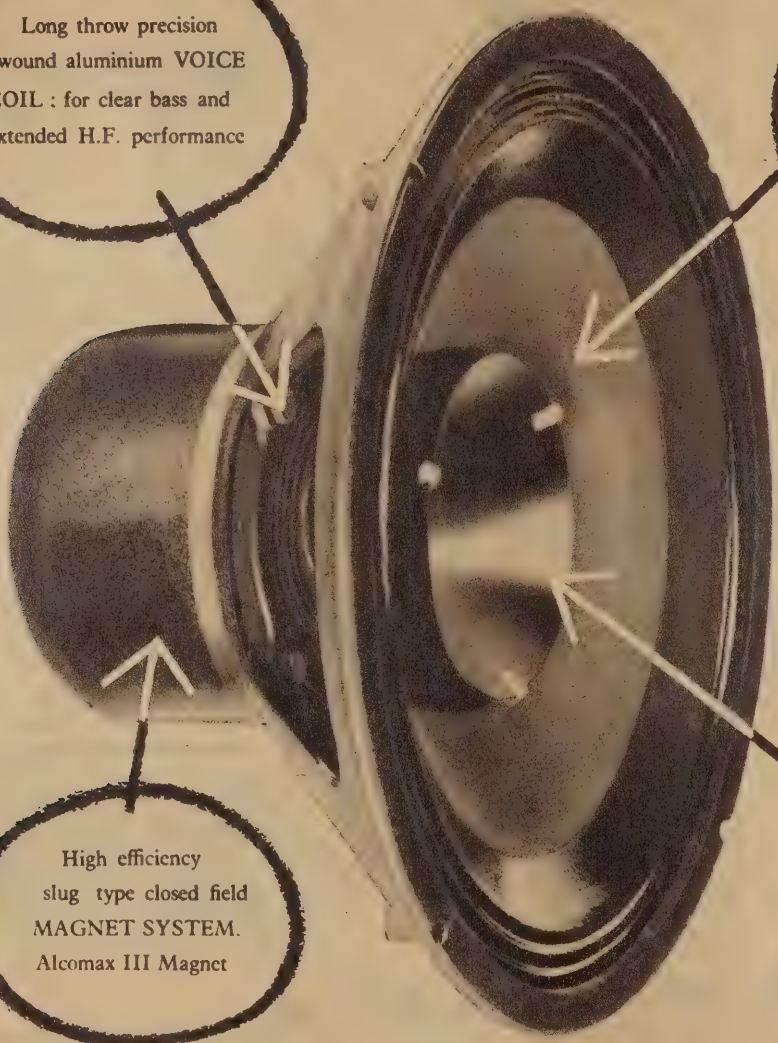
If you play a hose on to a tree you will find that the water first runs off

Plants like these, of the pine type, are transferred, when very young and delicate into metal cylinders, filled with suitable loam. When they have grown, under nursery conditions, to about one foot high, and still in their individual cylinders, they are despatched for planting in areas where conservation measures are necessary. Many find their way into huge forests such as this one near Canberra, A.C.T.

STILL the best selling 12" High Fidelity Loudspeaker . . .

Long throw precision wound aluminium VOICE COIL : for clear bass and extended H.F. performance

Vacuum formed controlled edge BASS DIAPHRAGM with plastic termination providing smooth low frequency and mid-range output from 30 c/s.



High efficiency slug type closed field MAGNET SYSTEM. Alcomax III Magnet

HIGH FREQUENCY RADIATOR, automatic mechanical crossover. Fitted with terminators. Controlled low distortion output up to 16,000 c/s.

AXIOM 300

Price £29'2'6 (retail).
Fixed in all state capitals.

Frequency Range : 30 *c/s.*—16,000 *c/s.*
Fundamental Resonance : 35 *c/s.* *Power Handling Capacity* : 15 *Watts.*
Flux Density : 14,000 *gauss.* *Impedance* : 15 *ohms.*
The most advanced twin-cone High Fidelity Loudspeaker yet produced

GOODMANS

Australian Agent:
BRITISH MERCHANDISING PTY. LTD.
60 Clarence Street, Sydney. BX 1571

Post this coupon now for your FREE copy of the GOODMANS NEW HIGH FIDELITY LOUDSPEAKER MANUAL.

Name .....
Address .....
.....

the leaves and down the trunk because these are dry and "greasy." As the leaves and trunk get thoroughly wet the water ceases to run down so readily. It finds its way into the spaces in the bark and runs down much more slowly.

There is thus a mechanical delay of the flow of water down a thoroughly wet tree. The effect of this in a forest is to create a very considerable delay of the flow of water to the ground and on into mountain streams.

This matter has been extensively studied in Europe. There it has been found that a spruce forest will intercept about 39 per cent of a given rainfall, whilst a forest of broad leaved trees will intercept about 13 per cent. Thus the amount of water intercepted varies with the species of tree.

Snow is intercepted in a like manner. Much of it sticks to the leaves and branches.

RETAIN MOISTURE

Some forest trees will intercept as much as 55 per cent of snow. By preventing wind and sunlight from reaching the forest floor, trees reduce the melting of snow and the evaporation of moisture. A considerable amount of moisture is thus held back in the soil of the forest floor, resulting in a much longer flow of streams and springs in the hot summer months.

It is a well-known fact that streams often become dry when the surrounding forest has been removed.

In high mountain regions, like our own Snowy Mountains, snow will lie on the forest floor for some weeks longer than in the open. This is one reason why such regions are ideal for water conservation projects.

The forest floor, it must be remembered, is not just plain soil. It consists of layers which may be many feet thick in an old forest, of leaves and twigs, rotted undergrowth bound together by filaments of bacteriological growth and fungi, intertwined fibrous roots and masses of ferns and so on.

The upturned fallen leaves themselves intercept large quantities of water, acting as they do like little upturned basins. In short the forest floor is like a vast sponge which soaks up large quantities of water.

Lower forest temperatures, increased humidity of the air, reduced wind movements, lower soil temperatures all play their part in holding the water and preventing it running away in a sheet to flood streams and creeks.

LOOSELY PACKED

The floor of a forest is always loosely packed. Because of this it is a favourite place for home gardeners to gather topsoil and leaf mould for their pot plants and gardens.

All enthusiastic gardeners know that, to keep the soil of their gardens nice and loose a covering of lawn grass clippings or other vegetation is the ideal thing to give.

In a forest this protection of the soil is afforded by the crowns, twigs, branches and leaves of the trees which reduce the pelting force of the rain. The forest floor is therefore subjected to a gentle shower of drops falling from the trees.

In our high mountain regions, where low temperatures exist in winter months, the forest plays an important role.

Because of the high insulating qualities of the forest floor the heat of summer is more or less stored. In addition to this, heat is always being generated by bacterial action in the rotting process which is continually taking place.

This stored heat assures that the soil of the forest floor does not freeze so readily or does not remain frozen for so long a time as it does in the open. Thus the absorption of water is greater and the run off less. More water is thus conserved to feed the catchment areas which feed the streams, lakes and springs.

THAWS MORE QUICKLY

In the springtime, the soil of a forest thaws out much quicker, should it become frozen, and streams are fed much earlier.

Soil which contains large proportions of organic matter also contains certain chemical colloids which are produced by the humus contained in the soil. When such soil is exposed to the heat of the sun the organic matter with its important colloids is dried up and destroyed.

These colloids assume a sticky character when wet but become like powder when dry. No substance known can hold soil together as effectively as these colloids. In a forest floor, the soil is always damp and the conditions are ideal for the colloids to do their work. Remove the forest and the soil dries out, the colloids cannot do their work, the soil breaks up and erosion commences.

The soil of the forest floor, being highly impregnated with humus, can absorb up to nine times its own weight of water. One can easily imagine the effect of this great absorption in relation to the catchment of water.

European research has shown that the humus of beech needles will hold about four times its own weight of water. Calculations have shown that such a forest will hold an average of about 20 tons of water per acre and 50 tons per acre under the most favourable conditions.

Often a flood is the difference between ordinary high water level and the last one or two feet when the water breaks the banks.

This last foot or two is often prevented by forests which line a catchment area.

The soft forest floor is an ideal place for animals such as rabbits and burrowing insects to make their home. As a result of this habitation, the ground of a forest floor is honeycombed with burrows and other cavities. In addition to this, there are holes and tubes left by decaying roots and stumps of trees.

Water which is not absorbed by the soil percolates through and into these holes and cavities. Thus there is an ideal condition for slow run-off of water through the soil and on into streams and springs. This water is clean, being free from silt, thus the streams are free from silt and soil.

EFFECT ON CLIMATE

Forests have an important bearing on the climate of a locality. Large quantities of water are used by the trees themselves in order to build up their tissues. Some forests can consume as much as two thousand tons of water per acre per annum. What is not used by the tree is transpired into the atmosphere through the leaves.

Thus over a large forest the atmosphere is more heavily charged with water vapour than over land where there are no forests.

It is, therefore, seen that of the total rainfall over a forest, some of the water is intercepted and evaporated from the crown of the trees, some is lost by evaporation from the soil, some runs off

(Continued on Page 107)

SOIL LOST BY WATER EROSION

Surface water cut these channels near Dubbo, N.S.W., big enough to dwarf a man. The lost soil and the channel is a problem in itself but the silt also tends to block natural waterways.

PERFECTION IN STEREO REALISM

by TELEFUNKEN

TELEFUNKEN STEREO RECORD CHANGER TW562

Now that a full range of stereo records is readily available, Telefunken present this Stereo Record Changer for the discriminating listener. The performance of this Changer is truly amazing. Its crystal clear reproduction of full stereo sound gives the remarkable sensation of actually being present in the Concert Hall.

FEATURES: Model TW562

1. Full stereo reproduction with wide frequency response, 30 to 14,000 c/s, due to new type Ceramic Stereo Cartridge with Sapphire Stylii.
2. Full protection for your records by velvet smooth operation of mechanism and extremely light stylus pressure of 7 grams.
3. Easy operation by push button control.
4. Plays all records, Stereo or Monaural, with speeds of 78, 45, 33 1/3, 16 2/3 R.P.M.
5. Automatic changing. Plays up to 10 records, 7", 10" and 12" diameter.
6. Extra facilities for automatic repetition of any selected record.
7. Attractively finished with green lacquered deck, ivory tone arm and gold trim.

Retail Price £30/10/6 (including Sales Tax)

MANUFACTURERS SPECIAL PRODUCTS PTY. LTD.
47 YORK STREET, SYDNEY.

Technical Review

NEW FLUID AMPLIFIER CAN BE USED AS "FLIP-FLOP"

The U.S. Army recently released information on a new type of non-electric amplifier. It is called a fluid amplifier and was developed at the Army's Diamond Ordnance Fuze Laboratory in Washington.

INVENTORS of the unit — which may lead to a new family of control devices — are three civilian scientists at the lab, B. M. Horton, R. E. Bowles and R. W. Warren.

The fluid amplifier is approximately ¼in across and 3/1,000 deep. Unlike transistors and vacuum tubes that require voltage for operation, this amplifier uses gas or liquids under pressure as a source of power.

The inventors say the unit can perform amplification, feedback, digital computation, analog computations, normal mathematical functions and memory.

Operational speed up to 20 Kc makes this unit faster than other fluid systems with moving parts, but much slower than electronic circuits.

The basic idea of the fluid amplifier is shown in the left illustration.

A source of pressurised gas or liquid is applied to the power jet input. A low-power jet can be applied to the main jet stream to make it pass through the right or left output tubes.

DEVICE AMPLIFIES

As the power stream can be controlled by a much lower power level, the device can be called an amplifier.

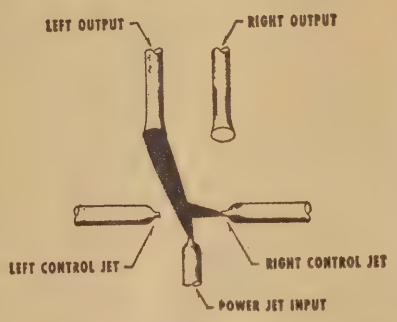
Operation of a typical flip-flop is shown in the illustration on the right.

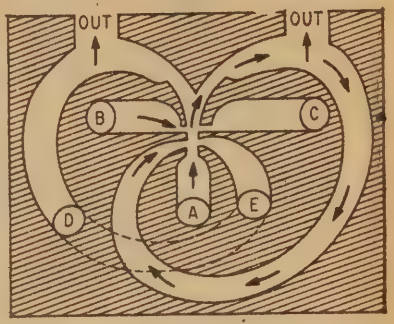
The main power jet input is at A. The pressurised fluid will pass through the throat into either of the two channels at the right or left.

Assuming that the control jet is applied through Channel B, then the fluid will flow around the right-hand channel back to the throat and be directed against the power jet to re-enforce the control jet applied through B.

With no control signal applied, the flip-flop will be stable in this condition.

When a fluid pressure is applied through channel C, then the jet stream will pass to the left-hand channel, through the orifice marked D, around the back of the flip-flop and out the orifice marked E and operate on the jet stream to make the other stable state. Output can be taken from either of the two sides.





Left: Deflection of the power stream by the control stream provides the basic amplifier operation. Right: Basic operation of the fluid flip-flop, showing the fluid feedback loop.

The gas or liquid power source can be any gas or liquid compatible with material used to make the body of the flip-flop. Bottles of compressed fluids, gas generators or the dynamic pressure of the fluid around the vehicle can be used.

The device can be used to drive pistons, air motors or can be coupled to similar units to perform logic functions. To transmit signals any distance pressure switches can be used to convert the pneumatic outputs into electrical signals.

— (From "Electronics").

AUTO ENGINE WITHOUT PISTONS

(Continued from Page 15)

engines can't run very fast. They become inefficient and even fly apart.

Rotating parts don't stop and reverse. They can operate safely and efficiently at very high r.p.m. — and that's the most effective route to high power, much better than jacking up displacement or compression ratio. This explains how the rotary engine packs so much punch into a small package. It spins very, very fast (17,000 revs. a minute in the prototype).

VALVE SPECIALIST

The man who finally transformed these textbook advantages into a working machine isn't even an engine designer, strictly. He's a specialist in valves and sealing techniques: 58-year-old, bald and bespectacled Felix Wankel, from the Black Forest.

Wankel started out as a book salesman but kept plugging away at engineering in a workshop at home. Some bright ideas for sealing high-pressure lubricating systems got him out of the publishing business and into full-time research. By World War II he was a wheel in the German Aviation Research Institute, developing sliding-plate valves for aircraft.

VE Day put Wankel back in his cellar workshop, with plenty of time to tinker. He had kicked around notions for a rotary engine for years. After all, sealing was the big problem and he was the sealing expert.

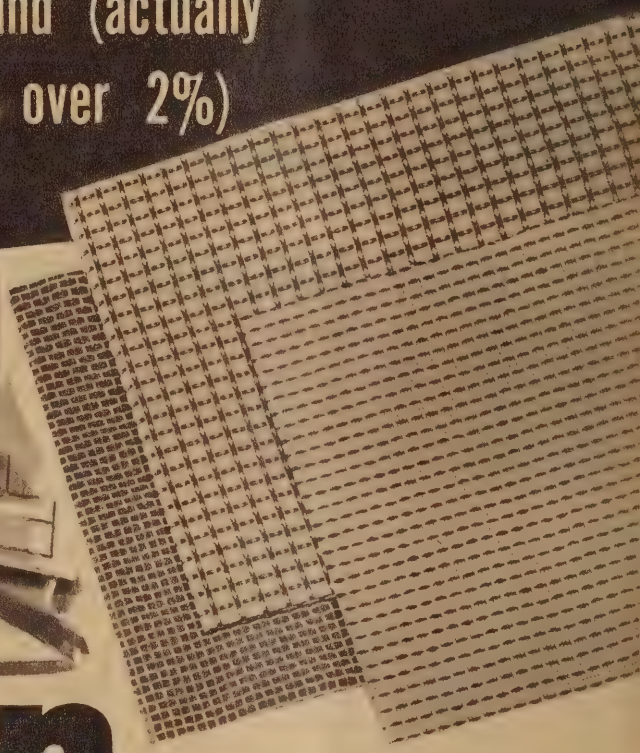
Wankel licked that. He also worked out the tricky geometry that makes the rotor sweep changing combustion spaces.

NSU latched on to Wankel's designs in 1951, first applied them in 1956 to a compressor for a tiny but conventional motor-cycle engine that set speed records on the Utah salt flats. The power plants for pumps, motorcycles, and the Prinz are still to come..

Meanwhile, NSU sold rights to build larger engines to Curtiss-Wright, the U.S. air-engine firm. This led to an international squabble over public announcement of the great invention.

Curtiss-Wright stole NSU's thunder by revealing a few sketchy facts at a party in New York. NSU blew its collective stack, privately. Publicly, it let out details.

At last! A beautiful speaker fabric that does not absorb sound (actually increases volume by over 2%)



Tygan High-Fi Fabric

Available in literally hundreds of colours, designs and weaves, Tygan High-Fi Fabric can make *your* set more beautiful. *Tygan is the most efficient speaker fabric ever.* Independent laboratory tests on the sound absorption characteristics of a variety of fabrics and fibres were recently conducted in the U.S. In reporting the results of these tests "American Fabrics" said that when an ordinary fabric was placed over the speaker the volume was reduced and the fidelity impaired. When Tygan High-Fi Fabric was placed over the speaker, an increase in the volume of up to 2% was noted. This is because Tygan does not absorb sound and even reflects some back into the speaker.

It's so easy to put a beautiful Tygan Fabric onto your set—it only takes about thirty minutes work.

IMPROVED FIDELITY IN HIGH-FREQUENCY RANGE UP TO 14,000 CYCLES

Ordinary fabrics absorb these overtones in music and sibilants in speech. Tygan High-Fi Fabric lets them through, allowing your set its greatest range of sound. This is why every major TV and High Fidelity set manufacturer in Australia uses Tygan.

Tygan is available in a wide range of designs and colour combinations from the following suppliers:

NEW SOUTH WALES
Arrow Electronics Pty. Limited, 422-424 Kent Street, SYDNEY.
Geo. Brown and Co. Pty. Ltd., 267 Clarence Street, SYDNEY.
Maurice Chapman and Co. Pty. Ltd., Kyle House, 31 Macquarie Pl., SYDNEY.
General Accessories Pty. Ltd., Box 23, Post Office, CHIPPENDALE.
Radio Despatch Service, 841 George Street, SYDNEY.
United Radio Distributors, 175 Phillip Street, SYDNEY.
Albert Wright, 793 New Canterbury Road, HURLSTONE PARK.

QUEENSLAND
Chandlers Pty. Ltd., Albert Street, BRISBANE.
Tracksons Bros. Pty. Ltd., 157 Elizabeth Street, BRISBANE.
Irvines Ltd., 129 George Street, BRISBANE.

VICTORIA
Electronic Developments, Nicholas Bldg., 37 Swanston Street, MELBOURNE.
Homecrafts Pty. Limited, 100 Leicester Street, CARLTON, N.3.
Howard Electrical and Radio Co., Vere Street, RICHMOND.
Master Electrics Pty. Limited, 547 Elizabeth Street, MELBOURNE.
Plastic Supplies Pty. Ltd., 208 Little Lonsdale Street, MELBOURNE.
Radio Parts Pty. Ltd., 562 Spencer Street, MELBOURNE.
Warburton Franki Ind. (Melb.) Pty. Ltd., 355 Lonsdale Street, MELBOURNE.
William Willis and Co. Pty. Ltd., 428 Bourke Street, MELBOURNE.

SOUTH AUSTRALIA
General Accessories Pty. Ltd., Flinders Street, ADELAIDE.
Limbert Radio Company, 16 Charles Street, ADELAIDE.
Newton, McClaren Limited, Leigh Street, ADELAIDE.

COLAN SALES PTY. LTD., 63 EUSTON ROAD, ALEXANDRIA, N.S.W. PHONE LA1631

REVIEW — A THERMOPLASTIC RECORDING SYSTEM

A new thermoplastic recording process developed recently in the General Electric laboratories in America combines most of the advantages of film and tape recording with some of its own.

THE process is the invention of a young G.E. scientist, Dr William E. Glenn. The process records an image on a thermoplastic layer on tape or film in the form of microscopic wrinkles on the surface. Under normal lighting conditions, the wrinkles are not apparent but, if the correct method of lighting is used, black and white and even colour pictures are projected.

Thus a slide transparency or movie film recorded using the new process appears to be perfectly clear when viewed by normal lighting. When inserted in a modified projector, however, the film is seen to contain brilliant colour pictures.

Dr Glenn hit upon the idea for thermoplastic recording when he was engaged in developing the Eidophor TV projection system. This system uses wrinkles caused by the impact of a modulated electron beam on a viscous fluid to modulate the intensity of the projection beam of light. Large screen TV pictures are obtained by this method.

The idea for thermoplastic recording arose when Dr Glenn realised that if the wrinkles used in the Eidophor process could be preserved on a tape or other suitable storage medium, a very useful recording system would be available. The recording system would be useful not only for TV, but for recording all types of electrical signals.

THREE-LAYER FILM

The film used in Thermoplastic Recording (called T.P.R.) consists of three layers. The thickest layer is the base material, which is about as thick as conventional movie films. Over this is coated a layer of conducting plastic, and finally the low melting point thermoplastic layer.

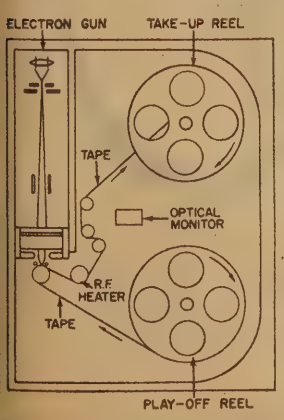
The recording process consists of three stages; first the film is passed under an electron beam, where the surface of the thermoplastic layer collects the electric charge pattern.

This process takes place in a vacuum chamber, as the electron beam would otherwise be affected by molecules of air. A vacuum pump is built in to the machine.

The film then crosses an electronic heater and eddy currents induced in the middle conducting layer heat the thermoplastic layer to above its melting point. The charge pattern on the surface of the thermoplastic layer then causes it to be attracted to the conducting layer in various amounts, forming wrinkles in the molten plastic.

A very short period after the film leaves the heater, it cools, leaving the wrinkle pattern permanently engraved on the surface. The word "permanent" is used here relatively, since the tape can be re-heated and used over again if desired. It thus has the full re-use features of magnetic tape.

The playback of the picture is done on an adapted movie (or slide) projector. As can be seen in the diagram, the wrinkles cause the light beam to be deflected and a modulated picture appears on the screen. The line light sources are arranged so that, in the absence of any surface modulation, no light reaches the screen.



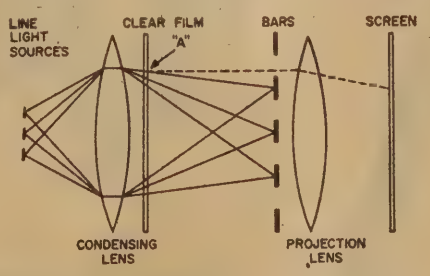


Figure 3: Video recordings are reproduced through a modified slide or movie projector. No modulation of the film's surface results in no light reaching the screen. A surface ripple, as at point "A," will diffract the light between the bars, allowing light to reach the screen.

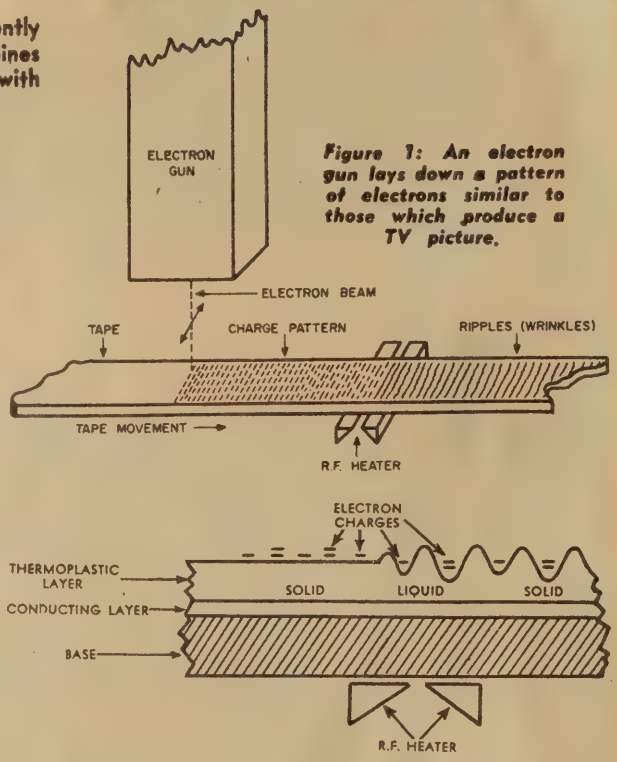


Figure 1: An electron gun lays down a pattern of electrons similar to those which produce a TV picture.

Figure 2: Side view of the recording film. When charged areas of the film are heated, stresses produced by the charges modulate the surface, thereby retaining the pattern.

Ripples on the film will deflect the light beams past the bars, and light will reach the screen. The colour projector operates in a similar manner, but prisms are used to obtain colours.

IMPORTANT FEATURES

The features claimed for thermoplastic recording are:

(1) It can be used to record anything that can be recorded as an electric signal; examples are TV pictures, sonar pictures, computor storage information, radar information and telemetry data.

(2) Both the recording and reproducing processes are instantaneous.

(3) Recordings can be used, erased and new recordings made.

(4) It can provide an image which may be viewed or projected on a screen but it needs no chemical processing.

(5) Duplicate recordings can be reproduced by stamping, like gramophone records. This is a much faster and more economical process than magnetic tape.

(6) The claimed bandwidth is phenomenal—50 megacycles. Thus the resolution is exceedingly good and a staggering amount of information can be crammed into a small space.

At the present, recorded pictures are about as big as an 8mm movie film frame (i.e., about 4mm square) but it is claimed that television pictures can be recorded on a tape one-tenth of an inch wide, which moves at the incredibly low speed of five inches per second. A half-hour TV program can thus be put on a spool of tape fitting in the vest pocket.

The inventor claims that it will be possible to record all the information contained in the "Encylopaedia Britannica" on a 2in diameter spool.

SCOPE IS GUARANTEED

Your Scope Tools are manufactured by methods that ensure the highest quality. Every tool is tested before dispatch and is guaranteed free from defects. Similarly, the National Scope Transformer manufactured by National Transformers Pty. Ltd. is guaranteed and backed by the resources of the largest transformer manufacturer in Australia.

SCOPE GUARANTEE IS ONLY VALID WHEN THESE TOOLS ARE USED WITH THE GENUINE NATIONAL SCOPE TRANSFORMER

WARNING

When purchasing a Scope Tool and Transformer be sure the Transformer is a genuine National Scope Transformer.

SCOPE LABORATORIES MELBOURNE

Australian and Overseas Agents:

Wm. J. McLELLAN & Co. Pty. Ltd.

126 SUSSEX STREET, SYDNEY. BX 1131

REVIEW — FLUORESCENT LIGHTS FOR RAIL CARS

A new inverter working at 1,250 cps permits 40-watt fluorescent light to operate from 24-volt DC battery. Transistorized equipment has been installed in British railway coaches.

By L. J. Gardner

CURRENT source for lighting British railway coaches is a 24-volt battery. To provide fluorescent lighting from this supply, the current must be converted to AC so that a step-up transformer can be used.

A small transistorised inverter, working at a frequency of 1,250 cps, has been devised for this purpose, and the first railcars embodying the new equipment have recently been completed. Either one four-foot 40-watt lamp or two two-foot 20-watt lamps can be run off each inverter.

Basic circuit for the inverter (shown in Fig. 1A) contains two pnp transistors and a transformer with three windings. Capacitor C is included to allow self-starting and resistor R controls the value of feedback current.

The circuit operates as follows. When the supply switch, S, is closed, the capacitor charges by way of the emitter and base of Q1. This current, flowing through the base and emitter, reduces the emitter-collector impedance (which is normally very high) and current begins to flow into the lower half of the primary winding, W1.

Thus, in effect, the charging current into the capacitor switches on transistor Q1.

REMAINS CUT OFF

While the current flowing in W1 produces magnetic flux in the transformer core and voltages are induced in all the windings, the polarity of feedback winding W2 is such that current passes through the emitter and base of Q1, and Q2 remains cut off, since the voltage across its base and emitter is in the reverse direction.

In these circumstances, the collector-emitter impedance is very low and the lower half of the primary winding is virtually connected directly across the supply voltage.

The rise in current in this part of the winding is, therefore, rapid and is limited only by the inductance of the transformer. While the current is increasing, magnetic flux in the core is also increasing and the change of flux maintains the voltages on all windings.

Once the current exceeds the critical value, the collector-emitter impedance begins to rise rapidly and, consequently, the rate of increase of both the current and the flux is reduced, as are the voltage induced in the feedback winding and the current fed into the base of Q1.

With the decrease in the collector current brought about by the reduction in the current to the base of Q1, the magnetic flux in the core begins to decline and the voltages across all the windings are reversed.

This reversal of feedback voltage switches off Q1 and switches on Q2, and the cycle begins again, but with current flowing into the upper half of W1.

For the operation of a fluorescent lamp, some form of series impedance is required, owing to the negative volt-ampere characteristic of the discharge. If a separate inductance is used in series with the lamp, it will cause additional losses.

This new British railway coach uses fluorescent lighting.

Therefore, the transformer is designed as a high-reactance unit, with the secondary winding loosely coupled to the primary. The circuit for operating two 20-watt lamps is shown in Fig. 1B.

It is similar, as far as the primary side is concerned, to that of Fig. 1A except that the starting capacitor is connected to the midpoint of the feedback winding instead of to the base of Q1.

The capacitor then charges up by way of the feedback winding, the base and emitter of Q1 and Q2 and the feedback resistor. There is sufficient asymmetry in the circuit to insure that either transistor is switched on by the current pulse.

One other difference from the primary circuit of Fig. 1A is the addition of a smoothing capacitor across the supply and a surge-limiting capacitor across the full primary winding of the transformer.

Without the smoothing capacitor, the current taken

(Continued on Page 77)

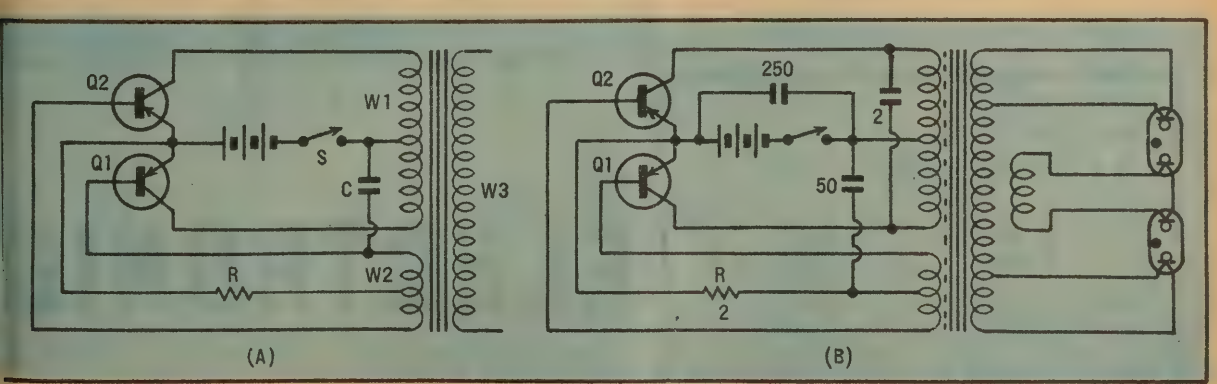
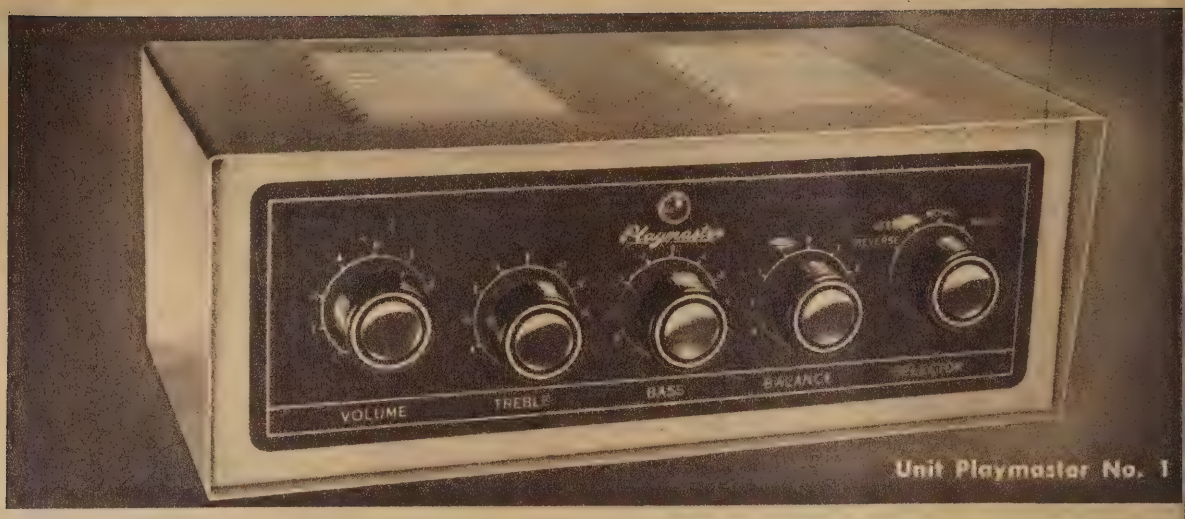


Figure 1: The basic inverter circuit (A) and (B) the modified arrangement for use with two 20-watt lamps.

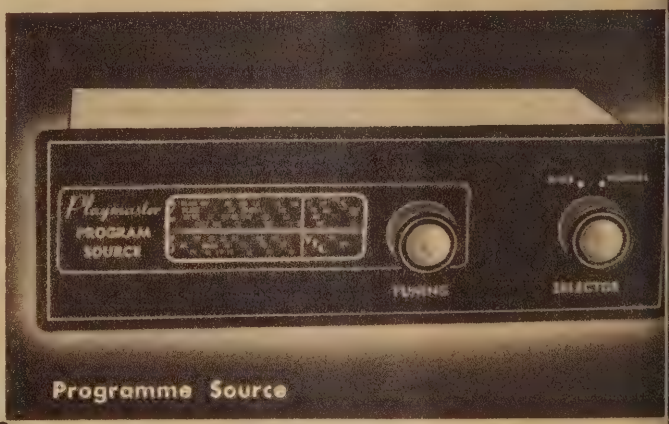


Unit Playmaster No. 1

YOU CAN SAVE MONEY WITH PLAYMASTER HI-FIDELITY!

Designed by "R.T.V. & H.," Playmaster brings you true hi-fidelity at far less cost than similar imported equipment. KITS OF PARTS to build yourself or ready wired and tested. The Playmaster range extends from the 34 Watt (Twin 17) amplifier to the latest unit Playmaster No. 1 (Twin 2½ Watts).

At right is the Programme Source, absolutely the smartest tuner yet. **Top right,** the 10 Watt (per channel) Stereo Amplifier with separate pre-amp. **Above** is the latest Unit Playmaster No. 1, a 2½ Watt (per channel) amplifier with inbuilt pre-amp. All escutcheons on Playmaster stereo equipment are beautifully anodised in deep bronze with gold lettering.



Programme Source

Send coupon for descriptive catalogue

To ELECTRONIC PARTS PTY. LTD.

Dear Sirs,

Please send me full details of the following (mark square for information required).

☐ **Playmaster Hi-Fi** ☐ **110° TV Kit**

Name.....

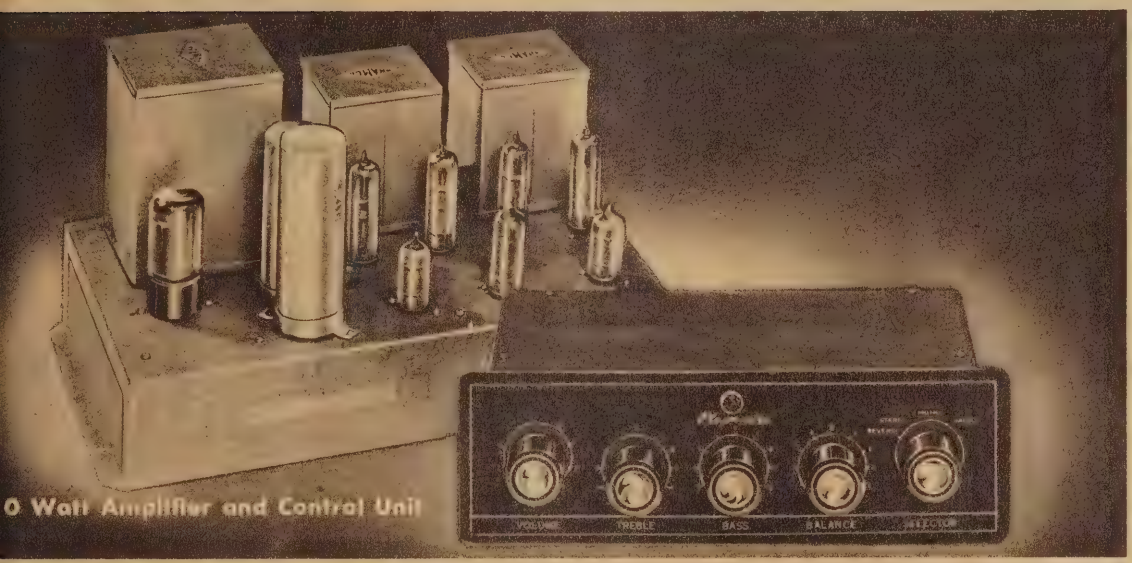
Address.....

.....

ELECTRONIC

THERE'S A PLAYMASTER FOR EVERY PURPOSE

- 17 Watt Stereo or Mono' Amplifier
- 10 Watt Stereo or Mono' Amplifier
- 4½ Watt Stereo Amplifier (with inbuilt pre-amp.)
- 5½ Watt Mono' Amplifier (with inbuilt pre-amp.)
- 13 Watt Mono' Amplifier (with inbuilt pre-amp.)
- 2½ Watt Unit Playmaster No. 1 Stereo (with inbuilt pre-amp.)
- Crystal Control Unit / Hi-gain Control Units — for use with 17 and 10 Watt Amplifiers
- Programme Source / Dual Wave Tuner / Wide Band Tuners / F.M. Tuner / Baby Tuner / Standard Tuner — for use with all Playmaster and most other Hi-Fi brands.

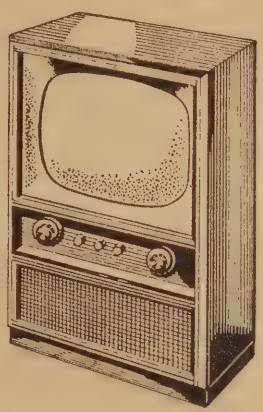


0 Watt Amplifier and Control Unit

110° TV Kit

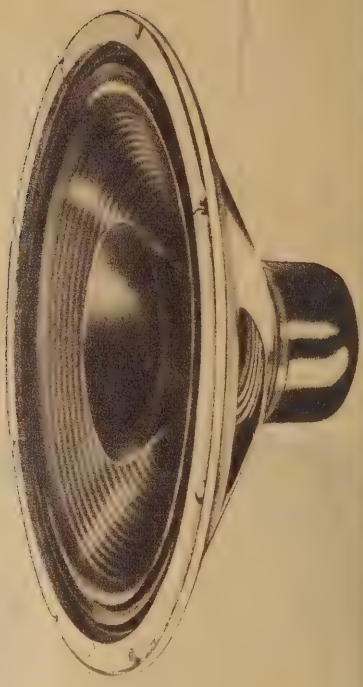
Build your own TV receiver to the "R.T.V. & H." design. Complete kit available with ready-drilled chassis, all valves, A.W.A. picture tube and deflection components, "Q" plus I.F. Strip ready wired and matched to Q+ or Philips tuner, etc., etc. FRINGE AREA version available. CABINETS and cabinet kits. LOW COST—amazingly low, and free delivery to capital cities.

Now available with latest AWA 23" PICTURE TUBE



PARTS PTY. LTD.

E.S. & A. BANK BUILDING
206 BROADWAY, N.S.W.
(opp. GRACE BROS.)
PHONES BA 4891, BA 4892-3



for living sound

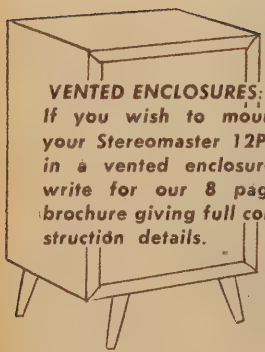
The New ROLA STEREO MASTER MODEL 12 PX

This new Rola loudspeaker provides the answer to the audiophile who seeks maximum performance at a reasonable cost. Its 20-watt peak power-handling capacity is more than adequate for home use, whilst its distortion-free frequency response — 45 c.p.s. to 12 K.C. — places it in the Hi-Fi class.

Like other loudspeakers in the Rola range, the 12PX has been designed and built to recreate living sound, and when used with equipment of comparable standard it will do just that.

Two Rola 12PX's will enable you to set up a stereo system for little more than the cost of a single Hi-Fi speaker of comparable performance.

Have your dealer demonstrate this fine new Rola 12PX so that you can judge its performance yourself.



VENTED ENCLOSURES: *If you wish to mount your Stereomaster 12PX in a vented enclosure, write for our 8 page brochure giving full construction details.*

BRIEF SPECIFICATIONS

Power handling capacity	20 watts peak
Diaphragm resonance	50 c.p.s.
Frequency response	45 c.p.s. — 12 K.C.
Voice coil impedance	15 ohms at 400 c.p.s.
Air gap flux density	12,800 gausses
Total gap flux	87,000 lines

ROLA COMPANY (AUST.) PTY. LTD.
THE BOULEVARD, RICHMOND, E.1, VICTORIA - - - JB 3921
CALTEX HOUSE, KENT STREET, SYDNEY, N.S.W. - - BU 6147

RE5

NEWS AND VIEWS OF THE MONTH

Television code

RULES to limit the amount of violence shown on television have been codified by the B.B.C. and issued to producers. They have been applied for a long time on the basis of various directives, and B.B.C. viewers will not notice any particular change.

According to Mr Kenneth Adam, Controller of Television Programs, who has prepared this detailed code of practice, a large number of American series offered to the B.B.C. are refused as being too brutal. Accepted cuts are made from time to time.

Dealing with the use of weapons in children's programs the code says: "The choice is important. Coshes, knives, whips and bottles are more suspect than revolvers or swords, because they are more easily available or improvised."

Space flight

ONE of the seven U.S. "astronauts" will get a 200-mile ride through space later this year to prepare for a 1961 launch into orbit.

First animals, then one of the astronauts, will travel in the U.S. Army's Redston rocket down range from the rocket test centre at Cape Canaveral.

Dr T. Glennan, chief of the National Aeronautics and Space Administration, said recently, "We confidently expect to send one of our astronauts aloft to an altitude of perhaps 120 miles and down range about 200 miles."

"Sick" jets

MICROBES make even jet aircraft engines sick.

This has been established by Dr John Leonard and Dr Dorothea Klemme, of the Naval Research Laboratory, in Washington.

It is not impossible that microbes have caused jet engines to fail in flight.

In any case they are a serious nuisance, and defence authorities are determined to get rid of them—if they can.

The "villains" are bacteria and fungi with an appetite for the kerosene-like fuel consumed by jet engines.

They thrive in jet fuel and create, as products of their feasting, scum which clogs filters and strainers.

Dr Leonard said they aggravated maintenance problems.

By clogging fuel pumps, they cut the rate at which planes could be put in the air from aircraft-carriers.

The microbes also reduce the efficiency of fuel by causing it, in a sense, to mix with water.

Normally, kerosene and water will not mix. Shake them together and they soon separate again.

But N.R.L. research workers found evidence that the microbes or their products act "as stabilisers of some rather bizarre emulsions of water and fuel."

The scientists found that microbes accumulate at "interfaces" between fuel and water.

Most direct way of getting rid of them is to make sure no water comes in contact with the fuel.

But water will get into storage tanks, and even into planes, one way or another, the scientists said.

Jet Hovercraft

THE Hovercraft, Britain's "flying saucer," will be fitted with a jet engine to double its speed from 30 to 60 knots.

At present it is powered by a piston engine which provides downward air jets and the forward thrust.

The additional small jet turbine engine will provide 880lb extra thrust. Fitting of the jet engine will extend the use of the Hovercraft as a research vehicle.

It will give valuable information about the behaviour of Hovercraft at increased speeds.

Missiles foiled

A NEW invention has made obsolete a whole generation of anti-aircraft guided missiles.

Many of the missiles affected were in service in Europe now.

The invention is a revolutionary electronic device known as the carcinotron.

It was developed in France, but it was believed to have been fitted to the British V bombers Victor and Vulcan.

When used as the heart of special equipment in bombers it could make useless the guidance system of some types of anti-aircraft missiles. It also could jam radar.

By giving bombers a much greater degree of immunity to attack than was previously possible it would enhance their deterrent value for many years to come.

The equipment gave the planes carrying it zones of protection extending for many miles.

This, combined with the distance from the target at which a "stand-off" bomb could be launched, greatly increased the chances of a successful attack.

Contamination monitor

A PORTABLE contamination monitor, which carries its own battery supply and uses dualphosphor techniques for simultaneous monitoring of Alpha and Beta contamination on laboratory benches and other surfaces, was demonstrated recently by E.M.I. Electronics Ltd.

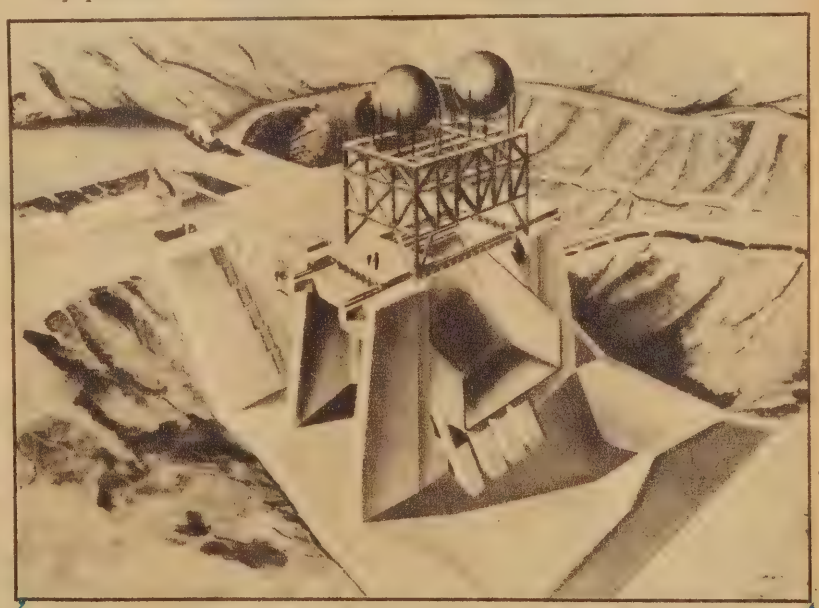
The E.M.I. dualphosphor system makes it unnecessary to go over the same area twice with Alpha and Beta probes.

Using all-transistor circuitry for long life and utmost dependability, the monitor gives high accuracy over the 0 degrees C. to plus 45 degrees C. temperature range.

Wembley Stadium

ASSOCIATED-REDIFFUSION, the ITV firm, is buying Wembley Stadium, home of the FA Cup Final and Britain's most famous sports arena.

But the £2,670,000 takeover bid will not affect sport at Wembley—or squeeze out the B.B.C., according to football-fan, Mr Paul Adorian, A-R managing director. "We won't interfere with sporting events there in any way," he said. "And we hope the B.B.C. will continue, and even extend, their sports coverage at the stadium."



Scheduled for completion during 1960, this huge rocket engine test stand, here shown as an artist's drawing, is intended to cater for thrust levels of around 6,000,000 pounds. Designed by the Aerotron Division of the Aerojet General Corporation, it is sited near the Edwards Air Force base, California. It will be the largest rocket engine stand in the free world.

just released!

FIRST SHIPMENT OF THE NEW

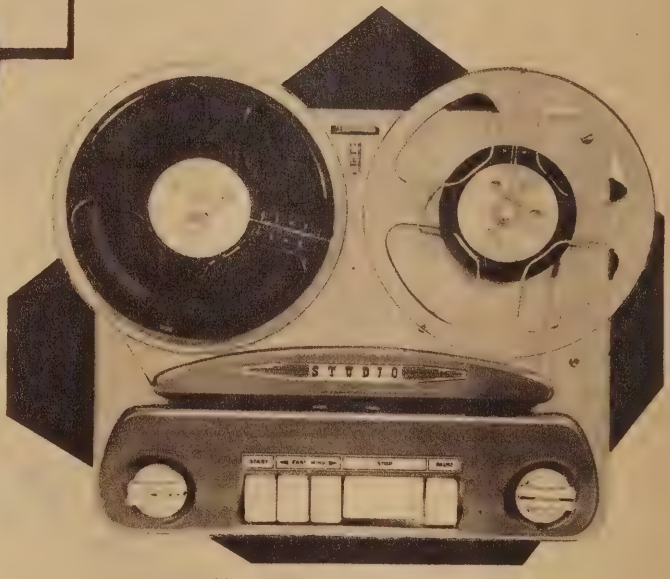
COLLARO STUDIO TAPE TRANSCRIPTION DECK

FINEST QUALITY FULLY IMPORTED!

UNBEATABLY PRICED AT ONLY

£31.8.6

(INCLUDES TAX)



SPECIFICATIONS

Medium	Standard ¼" Plastic or paper base coated tape.
Track Width	.087"-.091".
Number of Tracks	Two.
Record/Playback Sense	Left to Right only.
Number of Motors and Type	Three. Four pole, Induction, dual voltage.
Voltage	200-250V. 50 cycle & 110/50 cycles by change of connections; 110V. 60 cycles by change of motors.
Operating Consumption	Max. 24 watts at 230 volts.
Operating Speeds	1⅞", 3¾" and 7½" per second.
Number of Heads	Two.
Head Types	One Record/Playback, one Erase.
Heads, Additional	Space provided for the fitting of a monitor head or a stereo playback head.
Record Head Gap	.00025".
Record Head Impedance	30 K ohms at 10 KCS.
Attainable Frequency Response	12 KC at 7½" per second ± 3 db with Record/Playback equalisation.
Recommended Erase & Bias Frequencies	45-60 KCS.
Erase Head Impedance	200/300 ohms at 45-60 KCS.
Erasing Voltage	Approximately 25 volts at 120 M/A.
Playing Time	120, 60 and 30 minutes per standard 1,200 ft. reel.
Rewind Times	65 seconds per 7" spool of 1,200 ft. 45 seconds per 5¾" spool of 850 ft.
Wow & Flutter	Not greater than .15% at 3¾" p.s.
Long Term Speed Stability	Better than .5%.
Dimensions	
12½" x 10⅝"	With 5¾" spools within the confines of the Unit Plate. With 7" spools overlapping Unit Plate.
Plane of Operation	Horizontal.
Weight	14 lbs.

NEVER BEFORE SUCH HIGH QUALITY AT SUCH A LOW COST

Sole Australian Distributors:

7644

ELECTRONIC INDUSTRIES IMPORTS PTY. LTD.

VIC.	N.S.W.	S.A.	Q'LAND	W.A
139-143 Bouverie St.	121 Crown St.	90 Grote St.	372 Ann St.	68a Railway Parade
Carlton — 34-4161	East Sydney — FL 5041	Adelaide — LA 5295	Brisbane — 2-6462	West Perth — 28-3111

Amphibious sidecar

AN amphibious sidecar, built of marine plywood and with its own marine 80cc engine, has recently been put on the market by a British firm that makes sidecars for motor cycles.

According to a B.B.C. correspondent, it is a remarkably adroit piece of workmanship. Fitted on to its parent motor cycle it seems not much bigger than a family sidecar, but far more sleek and handsome, and it is sold at only £175 sterling.

It seats two normal adults comfortably with room for baggage. Timed recently by stop-watch, it took one and a half seconds to clear it from the cycle and two and a half seconds to lower it into the lake. Returning it to the chassis and fixing it back into the locking position took exactly five seconds.

Microbes in space

A "WAR of the worlds" now is conceivable.

But the invaders most to be dreaded would not be intelligent Martians with great mechanical tripod legs and death rays.

They would be microbes brought to earth as stowaways by the first spaceship to make the round trip to Mars.

Scientists say organisms from bleak and arid Mars would multiply explosively in the more hospitable environment of earth and devastate the globe.

The chance of such an invasion may be remote.

But space scientists take it seriously enough to warn against letting it happen.

They also caution against transporting earthly microbes to Mars. That would jeopardise a scientific search for strictly Martian forms of life.

TV colour camera

A NEW E.M.I. colour camera uses three vidicon tubes and an optical system—several times more efficient than relay lens systems—which has been designed so that the maximum amount of light falls on the photo-conductive surfaces of the vidicons.

This gives an improved colour quality, even under difficult lighting conditions.

The camera, which is notable for its lightness and small size, is cheaper and easier to operate than conventional colour cameras. This makes it particularly attractive to operators who wish to obtain experience of colour studio work.

The versatile design makes the system suitable for broadcasting and telecine transmissions, as well as for use in industry and medicine.

New Ghana station

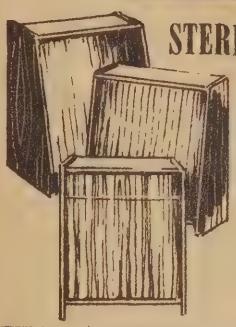
GHANA is to have the most modern high-power short-wave broadcasting system on the African continent. Four 100 kilowatt high frequency radio transmitters of the latest design, and capable of world-wide radio coverage, are to be installed in a new station at Tema, near Accra.

The Government of Ghana has awarded the contract for the design and erection of the transmitting station to Marconi's, the contract being valued at more than £600,000.

The equipment incorporates many special features. Rapid retuning is made possible by the provision of electrically operated circuits controlled from the front panel. Any one of six pre-selected frequencies can be set up by a single operator in three minutes.

SOUND ADVICE...

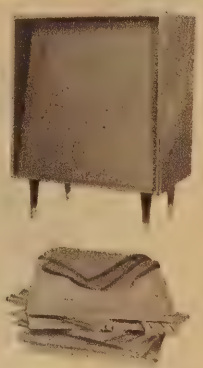
See ARROW first!



STEREOGRAM CABINETS

Outstanding value — the "G" series of matching speaker and control cabinets — available in maple, walnut or rosewood, beautifully polished. Speaker cabinets are fully felt lined, have plastic grille cloth and suit most 12in speakers with provision for optional A.R.U. and tweeter. Control cabinets have lift-up lid and will accommodate most players and amplifiers.

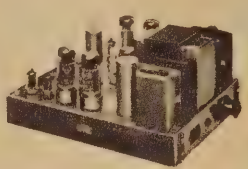
Price, per cabinet, £19/19/-



CABINETS, CABINET KITS →

Sherwood Cabinets, polished, felt lined, complete with legs and fitted with plastic grille cloth: £25/10/-.
Sherwood Kits: Kit to make the above cabinet, all you need is hammer, screwdriver and glue — in maple or walnut: £14/11/, less legs and grille cloth.
AK-12M Cabinets: Bookshelf R.J. cabinet for 12in speaker — 23in x 21in x 11in — sanded ready for polishing: £12/15/.
AK-12 Kit for above: £9/5/.
AK-8M Cabinets: As above, but for 8in speaker, 23in x 12in x 11in: £9/12/.
AK-8 Kit for 8in cabinet: £6/15/.

NEW "POINT ONE"* Stereo Amplifiers by LEAK



"POINT ONE STEREO" Pre-amplifier — the most flexible stereo control yet produced with a full range of inputs and controls: £60.

"STEREO 20" Two 10 watt power amplifiers on a common chassis — suitable for operation with Point One Stereo pre-amp: £87.
"STEREO 50" As above, but 25 watts per channel: £120.

Wharfedale

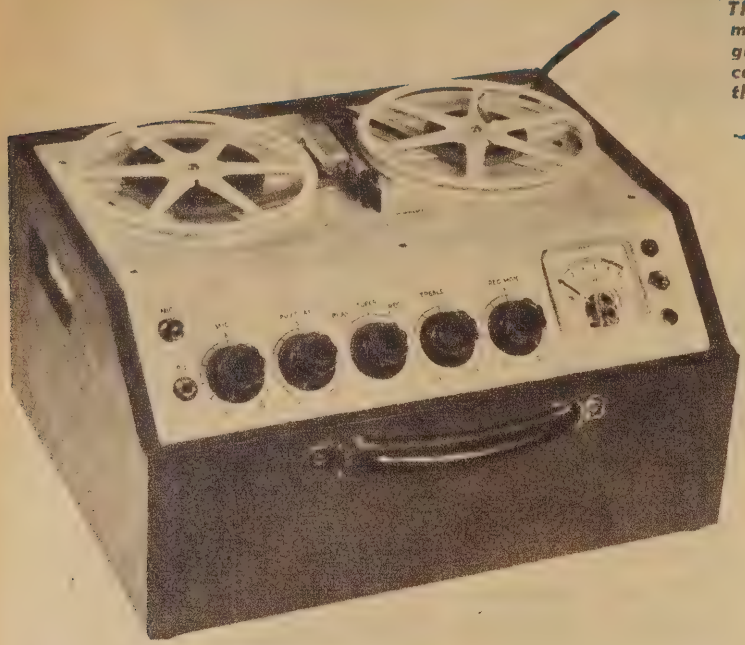
8in: From the 8in Bronze/AL at £7/5/10, to the 8/154 column speaker at £15/10/6 the 8in Wharfedale range offers economy, superior performance and compact installation.

10in: For excellent value, performance and moderate enclosure dimensions, 3 models from £11 to £25/5/6.
12in: For Bass, W12FS: £28/1/9. For full range work, the Super 12/FS/AL: £44/3/7 or the Coaxial 12: £64.
Further details available on request.

CALL, WRITE OR PHONE

ARROW ELECTRONICS PTY. LTD.

422-424 KENT STREET, SYDNEY. BX6731.



The complete recorder was built into a case made from half-inch plywood. The speaker grille was included on the rear face of the case, and ventilating grilles placed under the motor fan and on the visible side of the case.

Over the past few months we have, on numerous occasions, been asked for a circuit for an amplifier-recorder for use with commercial tape decks. In answer to these requests, we present here a design which incorporates many worthwhile features. It should prove suitable for many types of deck which readers may have on hand.

Amplifier Design For Tape Decks

THE design of an amplifier to suit the many available commercial tape decks is not a simple matter. The mechanical and electrical properties of the available decks vary—or have varied—to such an extent that such an amplifier also must be rather flexible (both mechanically and electrically).

On the mechanical side, the position of the reels, heads and tape guides varies widely from deck to deck and there is no standardisation as to the position, or even the number of controls provided for.

ATTRACTIVE COMPROMISE

One answer to this problem is to make-up the amplifier as a small "under deck" unit and to take the various controls up to available positions on the deck on floating leads. We personally do not favour this method, as one can easily find that one has too many controls and not enough places to put them. The amplifier is therefore restricted to the facilities originally envisaged, which may or may not be adequate.

Another solution is to include all the controls on the amplifier proper, making it a completely self-contained unit. While this avoids the restrictions mentioned above, it can result in a rather bulky unit, with controls and tape mechanism in completely different planes.

The approach which we are suggesting here is a very attractive compromise, avoiding most of the difficulties mentioned.

While specific dimensions and layout details had to be fixed to suit the deck which happened to be on hand, they are fairly typical and can, in any case, be modified to meet individual requirements.

The idea, briefly, is to place the controls on a long narrow panel, as can be seen in the photographs and to make this panel an integral part of the amplifier. The amplifier is placed under the deck, and the panel attached to the front, so that the controls are near the deck function controls.

By using a sloping panel for the controls, very little is added to the size of the recorder and, in addition, the controls are in a very convenient operating position. The panel can be made to overlap the front of the deck and unobtrusively blank off the pattern of unused holes.

DECK RESPRAYED

How neatly this is done, of course, is a question of individual aptitude. We sprayed the deck and panel with a matching coat of lacquer.

Suitable supporting spacers can be installed between chassis and deck at the rear, so that the two can be wired and handled as a rigid assembly, ready to slip into a suitable case.

But more of this later.

On the electrical side, we are confronted by a bewildering array of head impedances and outputs and a variety of tape speeds. There are also many operational features which are desirable. So many, in fact, that it be comes impossible to include them all, if only for the sake of economy.

It thus becomes a matter of choosing those features which one feels are most necessary and leaving the rest for those who have more financial resources available for such a project. We have managed, however, to include a number of features not found in routine tape recorders.

MIXING FACILITIES

Mixing facilities for microphone and pick-up inputs, for instance, are often needed in recording work but are not provided on the simpler type of recorder. We felt that a unit embodying such facilities would be very popular and so resolved to include this feature as a first step.

By suitably arranging the circuit we have, in fact, been able to go one better. It is possible, while the tape is playing, to use the original microphone circuit. Odd comments can therefore be made through the amplifier system, additional to what is on the tape.

A level meter is also very handy when one is doing any serious recording and is particularly desirable when musical programs or slide commentaries are being assembled. While the inclusion of such a meter adds substantially to the

By Jamieson Rowe

cost of the unit as a whole, we feel that it is a feature which is definitely worthwhile. At the same time, it can easily enough be omitted, if individual constructors prefer to do without it.

The advent of pre-recorded tapes on the market makes the provision of suitable playback characteristics very desirable. Unfortunately, standards seem to vary considerably, which rather complicates the matter. However, we felt that the existing recording characteristics were sufficiently similar to warrant the provision of compensation on playback which corresponds to an "average" pre-recorded tape.

Thus, while not all decks and heads will conform to modern concepts of hi-fi tape playback equipment, the overall result will have some deliberate relationship to current practice. This is more than can be said for many commercial recorders which have been made and sold.

ADEQUATE GAIN

Another feature to be considered, when designing a typical amplifier, is the provision of adequate gain for heads with lower than average output.

Most of the tape circuitry featured in this magazine some years back was intended for the high performance full-track heads then currently available. While the gain was ample for such heads, and even for many half-track types, there were others which clearly required higher playback gain.

Since the majority of decks which home-constructors are likely to have on hand will be fitted with half-track heads, high playback gain becomes an important consideration.

The provision of adjustable recording bias is a feature which is not often found on lower-priced recorders, but is again very desirable. It allows the amount of bias to be controlled, so that optimum efficiency and quality can be obtained with a particular head and tape.

A feature which is often needed, particularly by movie-film enthusiasts, is the provision for superimposition of speech (or music, for that matter) on to an existing recording on the tape.

Again this is a feature not often found on the simpler type of recorder, but it does not involve much added complication, and can be easily included. The slight extra complication and cost we feel is outweighed by the added versatility obtained.

MONITOR CONTROL

One other feature, originally introduced on our Number 2 recorder, has been retained. This is a separate monitor volume control on the speaker, which allows the speaker to be used to monitor what is being fed on to the tape. The control is automatically cut out of circuit on playback.

Having discussed these features, let us turn to the actual unit shown on these pages and see how they have been included. As we do this, we may as well examine the operation of the recorder and perhaps note any extra points which may make themselves apparent.

The first thing which you may notice is that there are two separate pre-amplifier sections—one for the microphone and one for the replay head output. This is done for a number of reasons; one is

TAPE COMPENSATION CIRCUITS

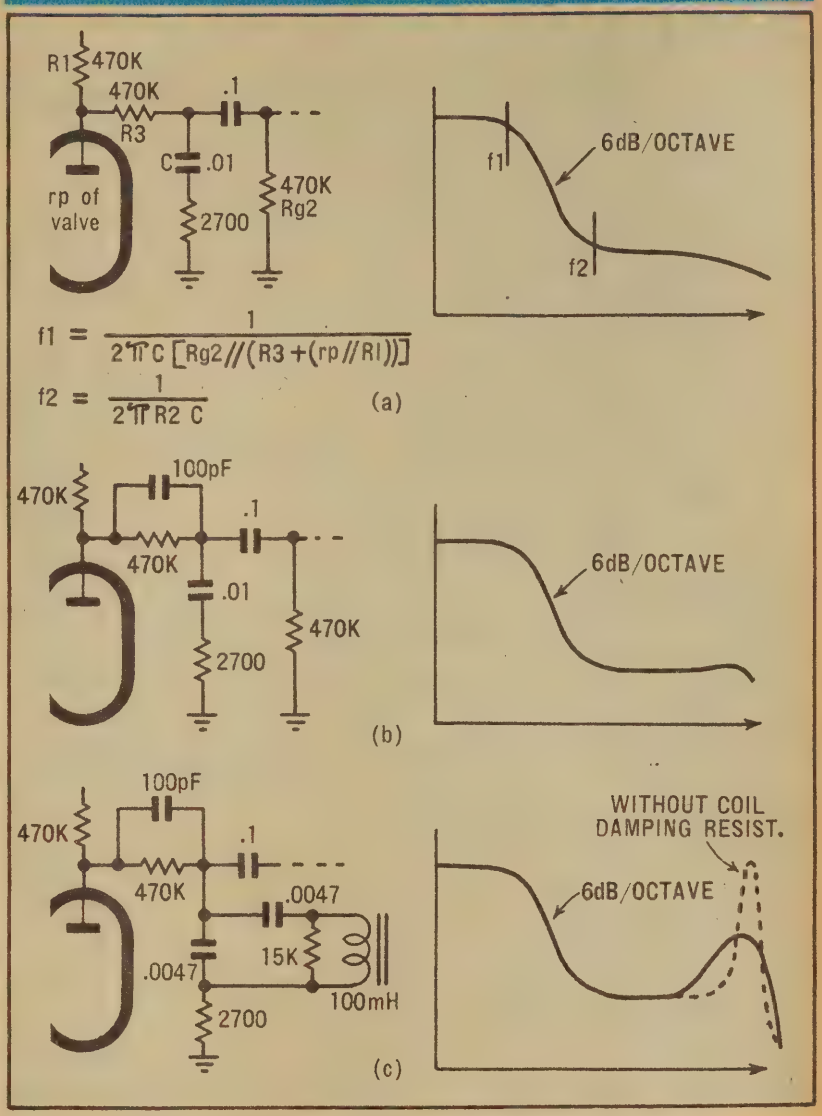


Fig. 1. This shows the evolution of the playback compensation network, and includes a modified circuit (part "c") which peaks the treble characteristic, allowing the response of poor heads to be partially corrected.

that it allows the microphone to be taken directly to a grid without being switched, thus reducing the hum problem so often associated with switching high impedance microphone circuits.

Another reason is that the use of a separate replay amplifier allows replay compensation to be done in its own pre-amplifier. If a single pre-amp. were used, switching would have to be provided to remove the compensation for recording.

In addition, a separate microphone pre-amp. allows the microphone to be used during playback to add comments to the material already on the tape.

As can be seen in the main circuit, the replay pre-amp. is a two-stage one, utilising an EF86 valve and one triode of the 12AX7. Between the two valves is the replay compensation network, which modifies the effective response of the amplifier to enable pre-recorded tapes to be reproduced faithfully.

If we look at Figure 1, we can perhaps get an idea of how this network functions. Basically, as section "a" shows, it consists of a capacitor C and series resistor R2 shunting the signal to earth. When the frequency of the signal rises, the reactance of the capacitor falls; when its reactance is equal to the effective generator impedance, the voltage output is 0.707 of the low frequeney output. This is called the lower turnover frequency f1.

UPPER TURNOVER

The output keeps falling with the rising frequency (with the normal 6 dB per octave slope) until the reactance of the capacitor becomes equal to the resistance of the series resistor R2. This point is called the upper turnover frequency f2. The output falls only a further 3 dB, and then flattens out until stray capacitances ultimately cause it to fall again at high frequencies.

ELECTROLYTIC CAPACITORS FOR EVERY APPLICATION

RADIO, TELEVISION, COMMUNICATION

U.C.C. manufacture a comprehensive range of radio-type single electrolytics. This range is covered in can sizes from ½" dia. x ¾" long to 1" dia. x 3½" long. The capacity voltage is in a combination of sizes up to 1,000 μF at 1.5 VW and up to 80 μF at 500 VW.

Check the following advantages and specify U.C.C. electrolytics for your equipment:

(a) All-aluminium, non-corrosive internal construction.
(b) Full hermetic sealing.
(c) Super-pure, high-gain etched foil and paper winding.
(d) Small size with adequate ripple rating.
(e) PVC sleeving on all insulated types.

The quality of U.C.C. electrolytic capacitors is guaranteed through high production standards and strict quality control tests during every stage of manufacture.

A comprehensive range of mounting styles is available, including pigtail and vertical mounting types as illustrated.

TECHNICAL DATA

CAPACITANCE TOLERANCE:
0 to 100 volts — 10% + 100% 101 volts and over — 10% + 50%

POWER FACTOR:
0 to 100 volts inclusive 30% at 100 cycles per second.
101 volts and over 15% at 100 cycles per second.

WORKING VOLTAGE:
This is the sum of the D.C. voltage and A.C. ripple voltage which can be applied to the capacitor for continuous operation.

PEAK RIPPLE VOLTAGE:
Is the instantaneous value of A.C. voltage across the capacitor caused by the A.C. component. This voltage, as a rule, should not exceed 6% of the rated peak working voltage at 100 cycles per second or 12% of the rated peak working voltage at 50 cycles per second.

PEAK OR SURGE VOLTAGE:
Is the maximum voltage the capacitor will withstand without damage when connected in series with the resistor having a value of $\frac{20,000}{C}$ ohms for 30 seconds: the voltage is measured across the resistor/capacitor combination.

LEAKAGE CURRENT:
All ER and ES type electrolytic capacitors have a finite leakage current. When first connected to a power source the charging current is high, but rapidly drops to a normal value as given by the formula:

$$I = \left(\frac{CV}{10} + 100\right) \mu A.$$

C = Capacity in microfarads.
V = Working voltage.
I = Current in microamperes.

It should be noted that the leakage current given by this formula is the maximum acceptable for satisfactory performance and is normally less than half this value. All readings should be taken at 25°C. after applying the working voltage for five minutes; plus one minute for every month of shelf-storage.

TEMPERATURE:
The effect of temperature is important and it is closely related to and affects all characteristics. The ratings of type ER and ES electrolytic capacitors are based on a maximum temperature of 85°C. The temperature co-efficients of capacity and leakage current are positive whilst that of the power factor is negative.

SHELF-LIFE:
Idle storage has a deteriorating effect on the anode film and should electrolytic capacitors be stored for any length of time they should be re-aged. This is most easily accomplished by applying 90% of the rated voltage to the capacitor in series with a 10,000 ohm heavy duty resistor.

Initially due to a high leakage current the voltage applied to the capacitor will be low, gradually increasing as the current decreases. When the leakage current reaches the rated value the capacitor is ready for use.

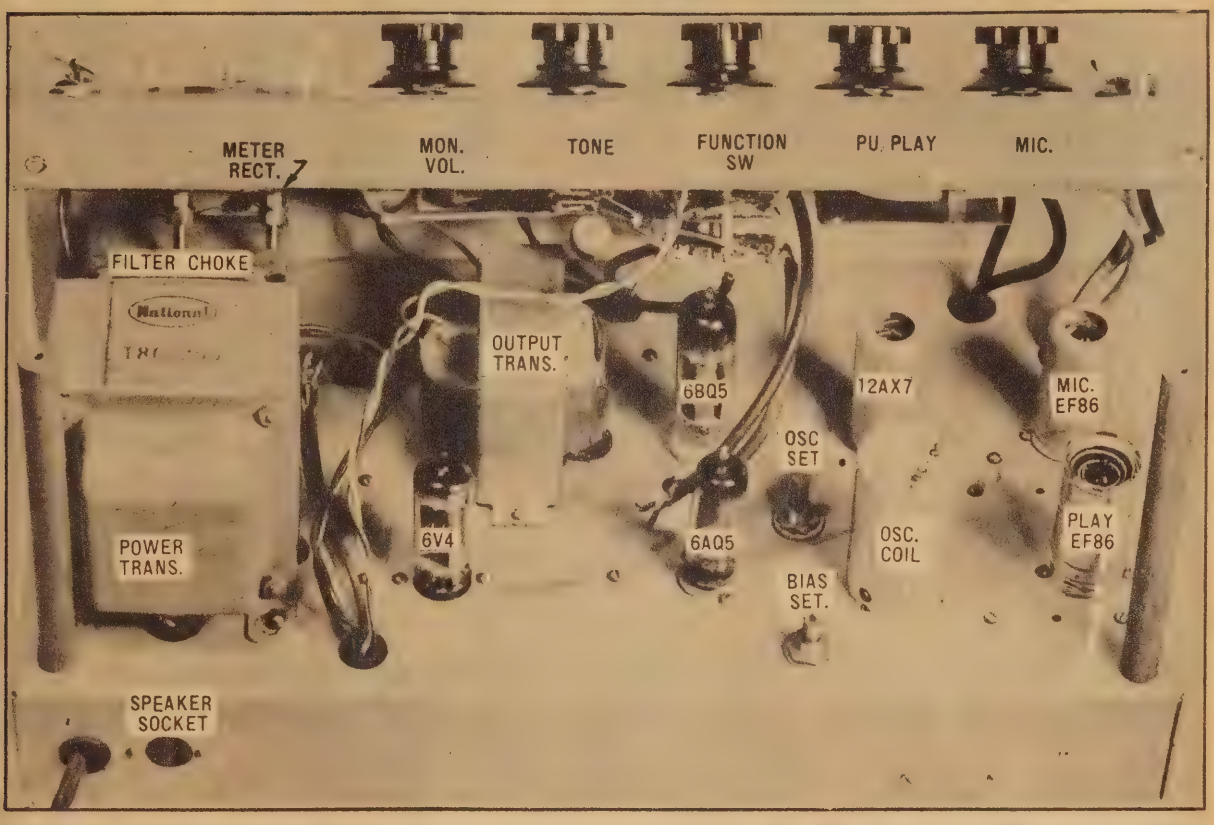
UNITED CAPACITOR CO. PTY. LIMITED

433 PUNCHBOWL ROAD, ENFIELD, N.S.W.

YB 0311

MELBOURNE	U.C.C. Pty. Limited, 486 Bourke St.
ADELAIDE	Stephen & Co., 53 Wyatt St.
BRISBANE	John Morris, 62-72 Albert St.
PERTH	O. F. Gamble, 931a Hay St.
TASMANIA	G. A. W. Wood, 46 Brisbane St., Launceston
NEW ZEALAND	H. W. Clarke (N.Z.) Ltd., 42 Cable St., Wellington

TOP VIEW OF THE TAPE RECORDER AMPLIFIER



Here is a view of the top of the amplifier with the tape deck removed, showing the valve layout. To the right are the two pre-amplifiers, then the oscillator coil and 12AX7, followed by the 6AQ5 and 6BQ5 valves. The rectifier is adjacent to the output transformer in the centre. At the left are the power transformer and filter choke, just visible under the level meter.

To counteract this fall in high frequency response, the 100 pF capacitor (see section "b") is wired shunting R3. This shunts the effective series generator impedance at high frequencies and thus provides treble correction.

The resistor R3, by the way, is to isolate the compensation network from the valve and tends to prevent variations in plate resistance from altering the compensation.

The playback response needs to be boosted at low frequencies, incidentally, to counteract the falling output from the replay head with falling frequency. This falling response is due to the fact that the head is a device sensitive to rate of change of magnetic flux. Thus, for a uniform frequency-amplitude signal on the tape, the output from such a head would be proportional to frequency.

LITTLE ATTENUATION

In practice, tapes are not recorded with such a signal, but have the high frequencies attenuated. Very little conscious attenuation is actually needed, however, since other factors such as tape response, gap factor, stray capacitances and bias demagnetisation attenuate the high frequencies to quite an extent. In fact, treble boosting is generally required, so effective are these other factors!

This boosting can be done either in the recording, in the replay, or as most often happens, in both. The degree of boosting required will depend on a number of factors, including the tape speed, the tape used and the head which is available on the deck.

In quite a number of available decks, the heads with which they are fitted have an inherently poor response and a fair amount of amplifier boosting must be used to compensate for this poor response. To cope with this requirement, we investigated the possibility of including a damped resonant circuit in the compensation network, in an effort to provide a peak.

RESULTS OF EFFORTS

The result of our efforts can be seen in section "c" of Figure 1. As you can see, the idea is to split the 0.01 mfd capacitor in two and to place a 100 millihenry inductor in series with one half. This results in a parallel resonant circuit at about 10 Kc/s, which can provide about 20 dB of boost at this frequency.

In the case of the particular head we were using, only 6 dB of boost at this frequency was needed, and we found that shunting the inductor with a 15K. resistor loaded the circuit sufficiently to drop the peak to this value. The inductor, incidentally, is a type normally made for use in a Whistle Filter circuit of a wide-band broadcast tuner, and should thus be easily available.

From the foregoing, it should be apparent that a certain amount of "tailoring" of the compensation may have to be done to obtain optimum results from a certain head. For instance, if you possess a head which has an exceptionally good high frequency response, the addition of a resonant circuit will not be needed, and the circuit can be used as shown.

On the other hand, if your head seems to have a rather poorer high frequency response, as with some of the rather nondescript heads which we tested, you may find that somewhat more boost is needed to produce acceptable results. As there is about 20 dB available, it should be possible to provide compensation for most available heads. It becomes merely a matter of selecting a suitable value of inductor damping resistor; the lower the resistor value, the less the boost obtained.

NOT SWITCHED

The next point of interest in the circuit is the mixing section. This is a normal "adder" type of two-way mixer, feeding into the second half of the 12AX7. You may notice here that, whilst the lower input is switched to provide the record-replay function selection, the upper input, catering for the microphone pre-amp output, is not switched.

This means that the microphone is connected to the input of the amplifier at all times. It is this feature which allows the microphone to be used to add

For faithful reproduction... long playing life!

change to

METRO-SOUND

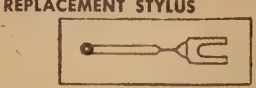
MASTER POINT REPLACEMENT STYLUS!

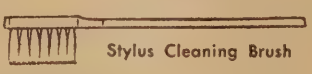
SAPPHIRE and DIAMOND

List No. M.S6
Sapphire Point

For B.S.R. T.C.8M., and T.C.8H.
78 R.P.M. only

THIS IS A
METRO-SOUND
"MASTER POINT"
REPLACEMENT STYLUS





Stylus Cleaning Brush

Safely and conveniently packed, complete with nylon cleaning brush for extra care of records, the new Metro-Sound Master Point Stylus comes in a range to fit all pick-ups and cartridges.

For full enjoyment of your finest recordings, see what a difference a Master Point makes.

You can buy Metro-Sound Master Point from leading record suppliers . . . a complete range to fit all pick-ups and cartridges . . . for stereo as well as monaural discs.

Trade enquiries to sole Australian Agents:

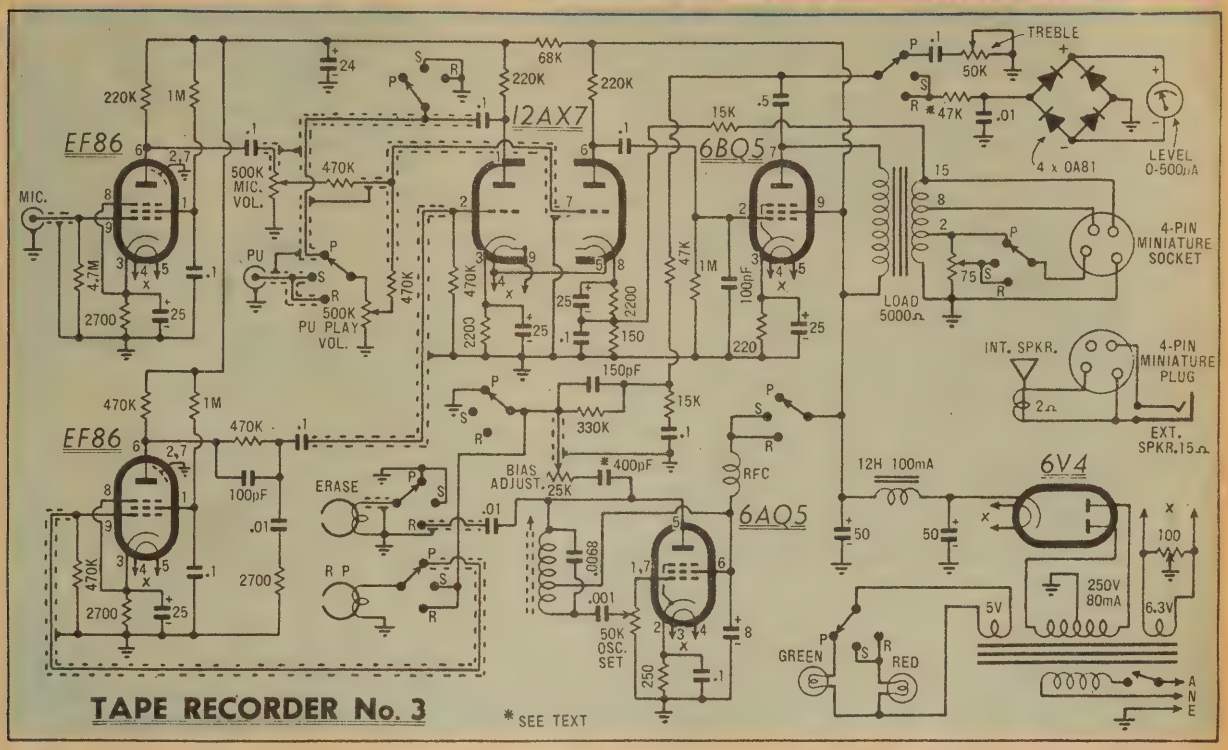
LEO ROGALY AND LEWIS PTY. LIMITED

35 Bathurst Street, Sydney. Phone 61-6607

VICTORIA: R. Feldman, 101 Punt Road, Windsor.

QUEENSLAND: T. A. Ferry, 77 Queen Street, Brisbane.

WEST. AUSTRALIA: D. B. Sharp, St. George's Terrace, Perth.



This is the complete circuit of the recorder showing the features included in the design. There are only six valves used in the circuit, but it incorporates many features not found in recorders of the cheaper variety. The compensation network shown here in the playback pre-amp is the non-resonant version, suitable for higher quality magnetic heads.

extra comments to pre-recorded tape material on playback, without having to add the comments to the tape itself.

It also means that the microphone can be used during playback with the tape stationary, using the recorder as a public-address amplifier. It thus becomes very simple, for example, to explain slides in a presentation, additional to those included in the taped commentary.

The remainder of the amplifier is fairly conventional, apart from the record function and speaker switching. Voice coil to 12AX7 cathode feedback is included to improve the distortion, noise and treble response. The speaker switching circuit is virtually the same as that used in the No. 2 Recorder, and allows the speaker to be used as an adjustable monitor during recording.

IMPEDANCE MODIFICATIONS

The value of the potentiometer used for speaker volume is something of a compromise, incidentally. If it is low in value, it will dissipate too much of the output power, while if it is too high in value, its control will be limited to the upper end of the resistance and will be hard to set to a convenient level.

In practice on a 2 ohm speaker, the 75 ohm pot seems quite smooth in operation, and obviously would dissipate little audio power. If a 15 ohm speaker is used for the internal speaker, however, it may be advisable to increase this pot to 150 or 200 ohms. In any case, the connections should be made to the 15 ohm tap on the output transformer if an internal speaker of this impedance is used.

There is a 100 pF bypass attached to the output valve grid, you will notice. This was included because radiation of bias during recording can be picked up in the earlier portion of the amplifier and may cause distortion due to overload of the output valve. This capacitor shunts signals of bias frequency to earth, without unduly affecting the high-frequency audio response of the amplifier.

MIXER SHIELDING

To keep this pickup of bias to a minimum, by the way, it is advisable to shield the resistors of the mixing circuit particularly. As the photograph of the rear of the control panel shows, we used a piece of sheet copper earthed and bent around the mixing components. It should fit rather closely for best shielding, but care should be taken to ensure that it does not touch and cause shorts.

The circuitry attached to the output plate must now claim our attention. As you can see, there is a switch coupled to this plate and this switch is part of the record-replay function switch. In the replay position, it connects a treble-cut type of tone control into circuit, allowing the tone to be adjusted.

In the superimpose and record positions, however, the tone control is removed and the level meter connected for monitoring of the recording signal. This arrangement of switching is desirable, as the meter is not required for playback and it is unnecessary to provide tone adjustment in both the record and replay positions. In fact, it can be a trap!

The level meter circuitry is quite conventional, using a 500 microamp movement and four germanium diodes in a bridge arrangement. The rectifiers are fed from a dropping resistor, and a bypass capacitor is included to prevent bias voltages present during recording from causing a false reading.

The actual value of the series dropping resistor and hence the level meter calibration will depend on the recording head used. The best method here seems to be to borrow a tape which has been recorded on a reliable machine and use it as a guide to recorded signal level.

TRANSIENT EFFECTS

The level meter resistor can then be adjusted so that the signals you record as a result are about the same amplitude as those on the reference tape. The level meter should be calibrated so that normal recording level corresponds to the "5" mark on the scale, i.e., half scale. This allows sharp peaks to fall in the 7 to 10 or red region of the scale, and quiet passages to fall in the 0 to 5 region.

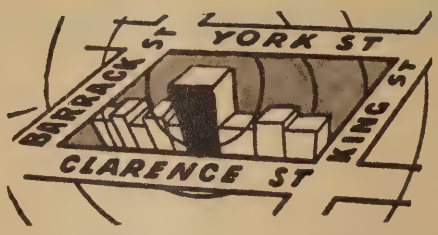
A point to watch in connection with level meters is with respect to transients. As a meter is a mechanical device, it has a very limited transient response and thus gives readings which are considerably lower than the true amplitude of the transient. To compensate for this, one should always set the recording level of high-transient program material to a lower indicated value than that used for relatively transient-free material.

GENERAL ACCESSORIES

PTY. LTD.

100 Clarence Street, Sydney

Phone BX4451

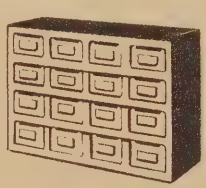


HANDY CABINETS

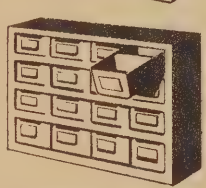
A craftsman built unit attractively painted in pearly grey baked enamel with provision for fittng identification card on each drawer. A strong and most useful cabinet for holding small parts or tools, ideal for mechanic, engineer, garage, store-keeper or home workshop. Provision is made for stacking and all units will interstack.

Available in the following Models Packed in a Strong Carton.

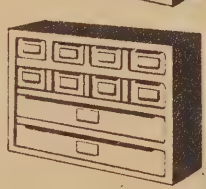
MODEL A
52/-
Cabinet 12" x 9" x 5½". 16 drawers 5½" x 2⅝" x 1½".



MODEL H
55/-
As Model A—but fitted with Divisions.



MODEL D
52/-
Cabinet 12" x 9" x 5½" 8 drawers 5½" x 2⅝" x 1½". 2 drawers 11" x 5½" x 1½".



Bib Wire Strippers
6/3 ea.

Neon Test Screwdrivers
10/6 ea.

CRYSTAL SET BUILDERS

Single Gang Condensers, **1 guinea**
Q plus Headphones **£2/1/**
Spring Terminals .. .. **1/2 ea.**
Germanium Diodes
OA70—OA73 .. .. **6/1 ea.**
OA81—OA85 .. .. **7/1 ea.**
Jabel Crystal Coil .. .. **8/6 ea.**
Aerial Wire (100ft) .. .. **14/9 ea.**
Insulators .. .. **1/ ea.**
Boys' Book of Crystal sets **5/ ea.**
Single Crystal Earpiece, complete with lead and plug **18/6**

MANUALS

Radio Servicing No. 1 .. .. **7/6**
Radio Servicing No. 2 .. .. **8/9**
Radio Servicing No. 3 .. .. **7/6**
Fault Finding **7/6**
Magnetic Recording Wire and Tape **7/6**
Transistor and Crystal Diodes **7/6**
The Oscilloscope Book **8/**
Television Servicing No. 1 .. **8/**
Television Servicing No. 2 .. **8/**
Television Servicing No. 3 .. **8/**
Television Servicing No. 4 .. **11/-**

PHILIPS VALVE DATA BOOK NEW ISSUE
18/6, plus 2/1 postage.

SCOPE

SOLDERING IRONS 6 sec.

Standard **£2/10/-**
Instrument **£2/10/-**
Vibroscope **£1/15/-**
Transformers **£2/10/6**

GLEN RADIO AC/DC INVERTERS

50 watt inverters:
12, 24, 32, 50, 110, 230v DC input 230v 50 cycles AC output—
£22/9/6

100 watt inverters:
12, 24, 32, 50, 110, 230v DC input 230v 50 cycles. AC output—
£33/2/6

150 watt inverters:
12, 24, 32, 50, 110, 230v DC input 230v 50 cycles, AC output—
£37/1/3

RECORD CHANGER AND PLAYER SPECIALS

4 SPEED PLAYER
..... **£8 0 0**

4 SPEED CONQUEST CHANGER .. **£10 15 0**

4 SPEED 6 VOLT BATTERY OPERATED PLAYER **£13 12 6**

4 SPEED STEREO PLAYER **£12 12 6**

4 SPEED STEREO CHANGER .. **£17 10 0**

4 SPEED TRANSCRIPTION UNITS less pickup
..... **£20 0 0**

4 SPEED TRANSCRIPTION UNITS with Arm
..... **£26 15 0**

ALL BRAND NEW IN UNOPENED CARTONS

Fully Guaranteed

BE EARLY

Screw-type hole cutters

⅜" 7 pin **£1/9/-**
¾" 9 pin **£1/15/-**
1⅛" Octal **£2/18/-**

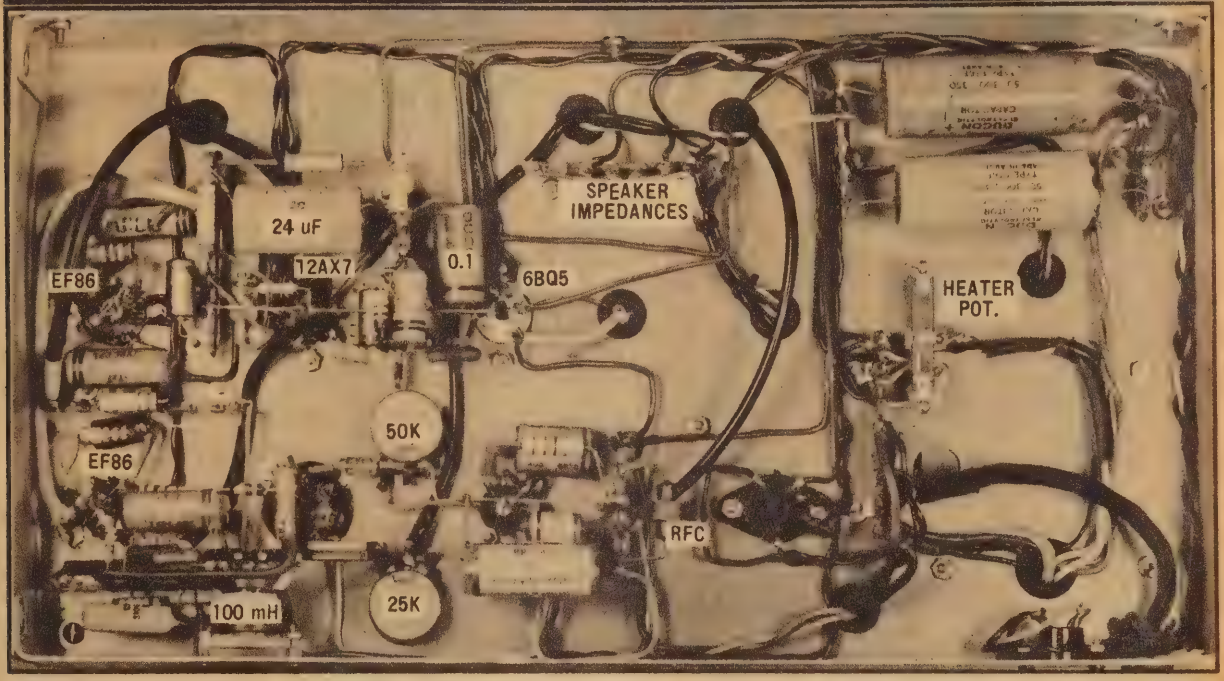
CRYSTAL SETS: Q-Plus set only **£2/13/6**
Q-Plus, complete with aerial, headphones, etc .. **£4/19/6**
Q-Plus Transistor model, complete with aerial, headphones, etc. **£6/19/6**

GOLDRING Crystal Lapel Microphones
30/ ea.

GENERAL ACCESSORIES PTY. LTD.

100 CLARENCE STREET, SYDNEY. PHONE BX4451
and 30 Buckland Street, Chippendale. Phone MX4701

AMPLE ROOM FOR WIRING BENEATH CHASSIS



The underneath view of the amplifier unit shows the under-chassis layout employed in its construction. The 100 mH peaking coil is visible in this photograph, as the particular head used at the time was rather lacking in treble response.

Thus the indicated level for piano solos, vocal shouts, percussion sounds and other peaky and transient-prolific material should be rather lower than that for such material as organ music, orchestral music of the smoother variety and other less peaky sounds.

From the same point as the switch rotor the recording signal is taken. A voltage divider consisting of the 47K and 15K resistors is used, to reduce the amplitude of the signal, with a 0.1 mfd capacitor wired in series with the lower resistor to provide a small measure of low-frequency recording boost.

From the junction of the two resistors, a series dropping network is used for further signal reduction. A shunt capacitor in this series network is used to provide recording treble boost, helping to raise the overall response. The head is connected to this network at the junction from the bias oscillator.

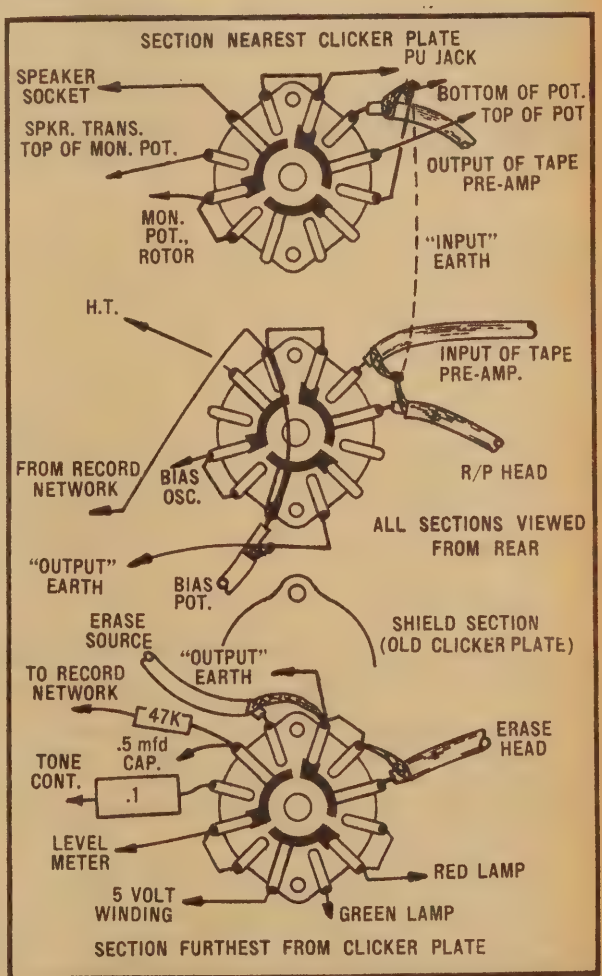


Figure 2. This diagram of the function switch wiring is intended as a guide to constructors, and should be followed to ensure satisfactory operation.

HARTLEY CIRCUIT

The bias oscillator is a conventional Hartley circuit using a 6AQ5 valve and is provided with a feedback control potentionmeter to adjust purity of waveform. This is best done with an oscilloscope, but a VTVM can be used to set the pot to the position giving least feedback for reliable oscillation. This is usually the position of best waveform purity.

An impure bias waveform results in distortion of the recorded signal, so such an adjustment is desirable if high quality results are desired. The frequency of the oscillator is adjustable using the tunable core of the oscillator coil and should be adjusted to as high a value as possible in the interests of good treble response.

The limit of bias frequency is governed by the erase head, however, and if the frequency is increased too far for the particular head used, erasure will not be complete. This is because the head is an inductive reactance and its impedance rises with frequency. At high frequencies, it draws less current and the flux available for erasure drops.

For least distortion of the recorded signal, the amplitude of the bias should be adjusted to a critical value. This value is dependent on the heads used, the frequency response

NEW *Releases!*
IN HI-FI TAPE RECORDERS

THE COMPLETE UNIT IS SUPPLIED IN ATTRACTIVE AND DURABLE TWO-TONE COVERED CASE COMPLETE WITH ACOS MICROPHONE AND FITTED WITH DUAL ROLA SPEAKERS.

The amplifier incorporates the latest "Mullard" tape recorder circuit equalised to C.C.R. standards giving perfect reproduction from recorded tapes. Outlet to power amplifier. Extension speaker outlet and "magic eye" level indicator. Amplifier is completely shielded and fitted with perspex dress plate to match deck. Output: 4 watts can be used as straight amplifier if required.

Model TR2 incorporates the new Collaro "Studio" Deck which features:–

- **High Fidelity. Frequency response 40 to 12,000 cycles at 7½in per second.**
- **Three 4-pole shielded motors.**
- **Three speeds, 1-7/8, 3¾ and 7½.**
- **Fast forward and rewind, 1200 ft in 65 seconds.**
- **Two track.**
- **Light piano key controls.**

- **PAUSE CONTROL**
This has the effect of stopping the transit of the tape past the "Record/Playback" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected positions. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.
- **TAPE MEASURE AND CALIBRATING DEVICE**
The three digit counter makes the location of any recorded passage the simplest of operations.
- **TRANSCRIPTION TECHNIQUE**
A large diameter flywheel with ground and lapped steel shaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter at less than 0.15 per cent at 7½in per second.

COMPLETE RECORDER WITH MIKE 69 GNS. f.o.r.

A NEW POPULAR PRICED RECORDER AT 49 gns. f.o.r.

MODEL TR3. For this recorder we have chosen the new English B.S.R. deck. This is a two track single speed unit (3¾in per second) giving two hours' playing on a 5¾in long play tape or one hour on a standard 5in tape.

Automatic locking device prevents accidental erasure. Frequency response 60 to 8,000 cycles.

The five valve amplifier including "magic eye" level indicator has two inputs, for microphone, radio, or pick-up; and outputs for external amplifier or speaker, equalised to C.C.R. standards. Can be used as straight amplifier if required. Output 3 watts.

The recorder is fitted in attractive two-tone case with dual speakers and microphone.

Overall dimensions 14in x 10in x 6½in. Weight 26lb.

CLEARANCE OF HI-FI MONAURAL EQUIPMENT

10 VALVE DUAL WAVE HIGH FIDELITY RADIOGRAM CHASSIS WITH R.F. STAGE. INCORPORATING THE MULLARD 5-10 AMPLIFIER AND TONE CONTROL CIRCUIT (SEPARATE BASS & TREBLE CONTROLS) AND SUPPLIED WITH THE NEW ROLA 12PX SPEAKER. **£38/10- F.O.R.**

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD. N.S.W. PHONE UA2145

CLASSIC RADIO TAKE PRIDE IN ANNOUNCING COMPLETE NEW RANGE OF STEREOPHONIC EQUIPMENT

Stereophon LIVING SOUND

16 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo, comprising a compact Hi-Fi Stereogram in two units featuring a high gain dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls in one unit and two Mullard 5-10 amplifiers with push-pull outputs and power supply on second chassis. **£69/15/-** F.O.R.

Two pair of M.S.P. Jensen speakers or two Rola 12in dual coned speakers supplied. Power output 10 watts per channel (20 watts). Frequency response of amplifier 40 to 15,000 cycles.

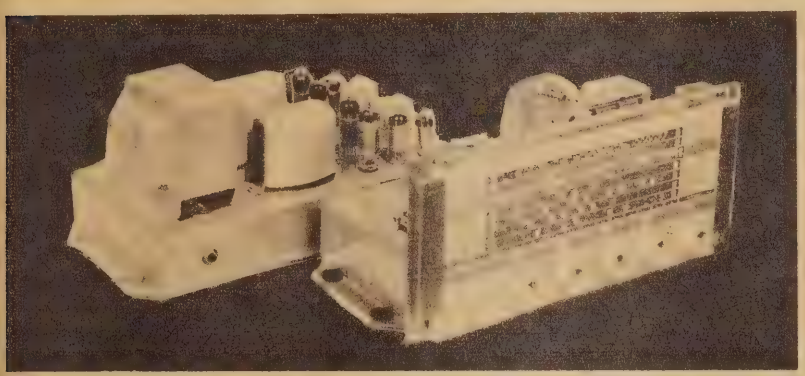
THIS UNIT CAN NOW BE SUPPLIED WITH THE NEW ROLA 12 PX SPEAKERS

10 VALVE HI-FI STEREOGRAM CHASSIS

Complete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX speakers. Power output 4 watts per channel. Frequency response of amplifier 40 to 15,000 cycles. **£49/15/-** F.O.R.

8 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo incorporating the "Mullard 2-2" amplifier circuit with separate bass and treble controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to 10,000 cycles. **£41/15/-** F.O.R.



ALL UNITS INCORPORATE THE NOW FAMOUS "MULLARD" AMPLIFIER & TONE CONTROL CIRCUITS.

Write for Full Specifications of STEREOPHONIC EQUIPMENT OR TAPE RECORDERS

SPECIFICATIONS OF OUR NEW HI-FI CHASSIS

NEW:

Ultramodern circuit using high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short-wave range of 12,000 miles. All valves used are the new Mullard nine-pin Innoval series.

NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving plus or minus 15 db boost or cut at 50 cycles L.F. and 10,000 H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW:

Dual speaker combination using the new Jensen M.S.P. 12PR woofer with matched tweeter and cross-over network giving a frequency response of 40 to 12,000 cycles. If required the Rola 12MX speakers can be supplied (with the 8 valve stereo chassis, two Rola 8MX speakers are supplied). A.W.A. output transformers used on all units.

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo F.M., or TV tuners and tape recorder.

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial can be supplied in cream or black with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.
All chassis are wired for the fitting of F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo. motor.
Power switch is fitted to volume control. Audio end of set can be used with TV receiver if required.

COMPLETE RANGE OF DUAL, COLLARO, B.S.R. AND GARRARD, STEREO PLAYING EQUIPMENT IN STOCK

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

KITSET SPECIALS

BUILD IT YOURSELF . . .
. . . FOR HALF PRICE

1. Reinartz (Batt.) 2
2. " (A.C.) 3
3. S/W 3 Band 3
4. Miniature (A.C.) 5
5. Interstate " 5
6. Dual Wave " 5
7. " " " 6
8. Portagram
9. Battery S/W Converter 1
10. " 2
11. Playmaster Tuner
12. Playmaster Preamp.
13. S/W A.C. Converter 1
14. " 2
15. All Wave A.C. Converter 2
16. 50 Mc/s Converter 3
17. 144 Mc/s Converter 3
18. Transistor 1
19. " 2
20. Transistor 3
21. " 4
22. " 6
23.. " 7
24. Transigram 4
25. Transportagram 7
26. Transistor Stereo Amplifier 1 Watt
27. " 4 "
28. Transistor 10w Amp.
29. 13 Watt Guitar and P.A. Amplifier
30. 25 Watt P.A. Amp.
31. 35 " " "
22. Mullard 3-3 Amp.
33. " 5-10 "
34. Twin 10 Stereo Amp.
35. " 17 " "
36. 21" 110d. TV Kit
37. Signal Tracer
38. Audio Oscillator
39. 5" W. Range C.R.O.
40. V.T.V.M.
41. R.C. Bridge

POPULAR KITS — AT ATTRACTIVE PRICES

HYBRID CAR RADIO £26/10/-	13w. GUITAR Amp. £14/12/6	MULLARD 2-2 STEREO £21/15/-	PROGRAM SOURCE £14/7/6
TRANSISTOR STEREO AMPLIFIER 4-WATT £29/12/6	25w. P.A. Amp. £21/12/6	MULLARD 5-7 STEREO £31/15/-	STEREO CONTROL UNIT No. 9 £13/7/6
R/C BRIDGE £21/12/6	35w P.A. Amp. £28/12/6	TWIN 10w STEREO £36/10/-	HI-FI 3 Amp. £13/7/6

TRANSPORTA 7 KIT

Proved by Sales to be the "Best Ever" Portable—Gives amazing distance reception with remarkable Volume and Tone. A TERRIFIC ADVANCE ON THE "TRANSISTOR 6"

CALL, WRITE, OR PHONE FOR FURTHER INFORMATION ON ANY OF THE ABOVE KITS

In addition to our standard kits, we also stock all Radio and TV Component Parts such as Valves, Picture Tubes, Condensers, Resistors, Transformers, (output and power), Record Players' and Changers, Speakers, Microphones and Accessories, Tape Decks, Transistors and Diodes, Instrument Cases, etc.

DON'T BUY . . . BEFORE YOU GET OUR QUOTE

MAIL ORDERS TO ALL AUSTRALIAN STATES—N.Z.—AND PACIFIC AREA.

ELECTRONIC DEVELOPMENTS

NICHOLAS BUILDINGS, 37 SWANSTON ST.

Phone 63-5973 MELBOURNE Phone 63-5973

A REAR VIEW OF THE CONTROL PANEL WIRING

This view shows the wiring at the rear of the control panel. The recording network is at the centre, partly obscuring the tone control. The mixer shield is at the right, bent slightly to reveal the mixing components.

desired and the tape used. Since very few people use only one type of tape, the bias value is thus something of a compromise, but a definite value can be provided which results in least distortion, highest efficiency and best frequency response for overall use.

For optimum bias level, some heads require rather a high value of bias current. To facilitate this, it is usually necessary to form a series resonant circuit tuned to the bias frequency. In our circuit, this is done by adjusting the value of the coupling capacitor. This is marked 400 pF in the circuit, but other heads than the one which we used may require slightly different values.

In series with the head and the coupling capacitor is a 25K potentiometer, which is used to adjust the bias both initially, and if touching up is desired for perhaps a certain tape. The procedure is thus to establish a series resonance using a suitable coupling capacitor, and then, using the pot, to touch up the bias to the optimum value when desired.

LOWERS Q

The value of this pot may seem rather small for the purpose but it does, in fact, vary the bias current over a sufficient range. This is because the circuit is a resonant one and a relatively small value of inserted resistance is enough to lower the "Q" and hence the current by quite a large extent.

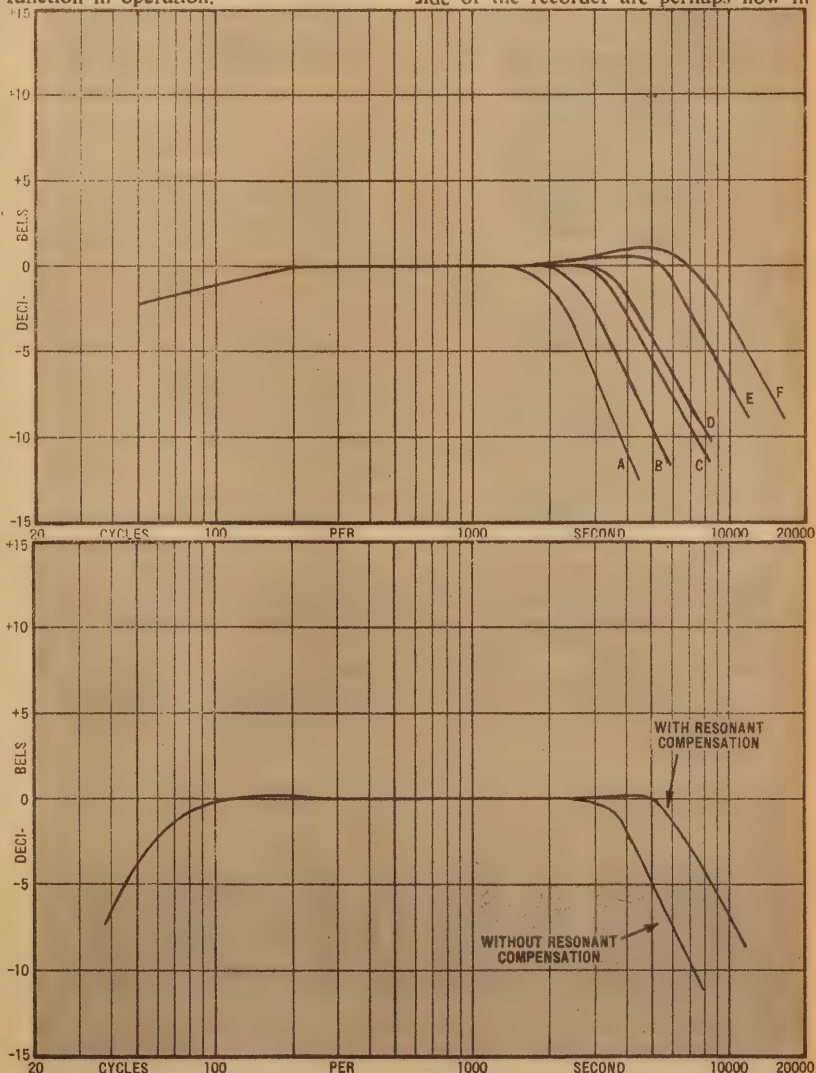
A point which should be mentioned here is the method in which the "superimposition" feature is provided. As you can see, the only circuit difference between this function and that of the recording function is that the erase head is disconnected. Thus the previous recording is not erased and superimposition takes place.

In point of fact, the bias current during recording does tend to erase the signal, particularly the high frequency content. In practice, this is no great disadvantage, since the added commentary is much more easily understood if the level of the previous signal is reduced slightly. Sibilants in particular suffer if they are recorded over other high frequency material.

All that remains is a few general points about the circuit. The power supply is a conventional full-wave circuit using a 6V4 valve. One section of the record-replay switch is used to operate red and green pilot lamps, which indicate the function in operation.

A hum-balancing potentiometer is connected to the 6.3 volt heater supply to enable the hum to be accurately nulled. Incidentally, in some cases the hum can be further reduced by a change in connection of the rotor of this pot. Instead of earthing it, a connection can be made to the cathode of the output valve. The best connection will depend on the components used and the particular layout employed.

A few points about the mechanical side of the recorder are perhaps now in



When the appropriate compensation is provided, the final overall response is dependent mainly on the characteristics of the particular head used. The upper curves to the right show the response obtained without peaking with several rather nondescript heads. The lower curves show the results obtained with the head having the upper curve "c" when peaking of about 6dB was applied.

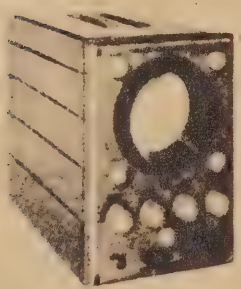
AWA TEST EQUIPMENT for EFFICIENT TV SERVICING

TELEVISION CALIBRATOR TYPE A56057

Frequency range: 19 to 260 Mc.
Crystal frequency: 2.5 and 5.5 Mc.
RF Output: More than 100 mV.
Provision for vertical and horizontal bars

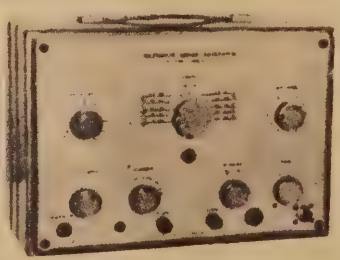
VOLTOHMYST TYPE A56010

DC volts: 0 to 1500 V.
AC. volts: 0 to 1500V.
Resistance: 0 to 1000M ohms.
DC. current: O to 1500 mA.
Accessories available for 30 kV and 250 Mc.



OSCILLOGRAPH TYPE A56031

Frequency range: DC to 1 Mc.
Time-base: 3 cycles to 30 Kc.
Sensitivity: 10 mV RMS/inch.



SWEEP GENERATOR TYPE A56036

RF frequency range: TV channels 1 to 10.
IF frequency range: 500 Kc to 50 Mc.
Sweep width: 0 to 10 Mc.
Provision for Oscillograph time-base and phasing control.

Brisbane and Northern Rivers readers, for further literature write to

CHANDLERS

Cnr. Albert & Charlotte Streets, BRISBANE 31 0341

order. As you can see from the rear view of the amplifier, the layout is quite straightforward and the amplifier is compact without being crowded.

All the operating controls are mounted on the front panel which was bent up out of 16 gauge aluminium sheet, as also was the chassis. Looking from the front, from the left we see the two input sockets, and then the two volume controls, one for microphone, the other for pick-up-replay.

Adjacent to these controls is the function selector switch. This has three positions, as stated previously in the discussion of the circuit. The tone control for replay is the next in line, followed by the recording speaker volume control.

LEVEL INDICATOR

The level meter is positioned near the right hand end of the panel, with the mains switch and indicator lamp bezels at the extreme end. In this way, the left hand end of the panel is associated with the input circuitry and the right hand end with the output circuitry.

Our particular tape deck measured 16in x 9in and had holes for a small number of controls along the front of the deck surface. As we did not intend using these holes, we brought the panel up and over the deck so that it covered the holes. The deck was resprayed with lacquer to provide a matching surface and the modification is not apparent.

As the front panel slopes rearward at 45 degrees, the various controls mounted at its rear overlap the top of the chassis. This means that tall above-chassis components must be placed to the rear of the chassis to clear these controls. The filter choke in our case fitted comfortably under the level meter, to the front of the power transformer, but the remainder of the above-chassis components were rather more rearward to clear the controls.

The above-chassis layout shown was decided upon as most suitable for our particular deck, incidentally. As you can see, there is a gap between the 6V4 rectifier and the 6AQ5 bias oscillator valves. This is the space occupied by the motor of our deck. Other decks may need the layout to be changed to clear motors and/or mechanism.

POINTS TO WATCH

There are a few points to keep in mind in reference to layout. One is that the power transformer should be placed as far as possible from the tape heads. In addition, we left the final mounting of the transformer until the circuit was tested, so that the orientation for minimum head hum pickup could be determined.

Another point is that the pre-amplifier circuitry and more particularly, the valves, should be placed as far as practicable from the motor or motors. Some motors radiate rather strongly, and the pulsating hum produced is very hard to remove if the pre-amp valves pick up this field.

An important point to watch is that the bias oscillator circuitry, and in particular its valve, is kept as far as possible from the input mixing circuitry and the pre-amp stages. Considerable aerial radiation can take place from this oscillator, with the results as stated before. As the rear photo shows, we cut a shield from sheet copper and bent

(Continued on Page 123)

FROM THE SERVICEMAN WHO TELLS

Funny stories, based on the strange ideas people pick up about radio and TV are always good for a chuckle when the service boys get together for a yarn, and I always try to pass on the best ones to my readers. Here are a couple I encountered recently, before we get down to more serious matters.

APPARENTLY, things are much the same in other countries. The first story I am about to relate was contributed to the American magazine "Radio-Electronics" by Mr L. M. Dilley, who is apparently a serviceman or technician of some kind. It was so good I felt I must pass it on. I quote Mr Dilley.

"How to repair a television set without tools, test equipment, parts, or tubes — this was my dilemma on a recent stormy winter evening while visiting friends in the country.

GLOOM

"I arrived to find a mood of gloom among the small fry of the household. The TV set had 'gone dead.' I consented to look at the set—a 17-inch Zenith table model. It was showing a slight raster and the usual slight hiss was audible from the speaker.

"I removed the back and chassis with a nail file and a rusty pair of gas pliers. A visual inspection revealed no glow in the second video IF, a 6CB6—the type used in all three IF stages and two sockets of the turret tuner.

"To check the apparently dead IF tube, I substituted a 6CB6 from the RF section. A faint picture appeared, accompanied by a fair amount of sound. This gave me an idea.

"I asked my host for a short piece of small diameter wire, and he produced a length of rusty soft-iron stove-pipe wire. I cut two four-inch lengths, scraping one end of each clean with the nail file. One length was then wrapped with one thickness of cellophane tape, the wires laid parallel and tightly twisted to form a capacitor. I separated the two cleaned ends slightly and inserted them in the socket holes normally occupied by pin No. 1 (grid) and pin No. 5 (plate) of the 6CB6 in the RF stage.

SUCCESS

"That did it! The sound came up with a boom and the picture became sharp and contrasty with very little snow. The set gave good pictures on all three available channels. In fact, the owner claimed that performance on channel 8 was as good as it had ever been.

"The payoff occurred the following week when a local technician was called to replace the missing tube. He was surprised how well the set performed without it. After removing the gimmick stove pipe capacitor he came up with this learned pronouncement: 'The reason your friend used iron wire was because it's magnetic. This caused it to work nearly as well as a tube.'"

I showed this story to a fellow serviceman when I first read it, and we both had a good chuckle over the punch line. And, of course, that started a general discussion about mutilated scientific facts in general, and those handed out by TV salesmen — and some servicemen. Of them all, the following is one I like the best.

According to my colleague—who, incidentally, is prepared to swear to this on a stack of Bibles—the story concerns two housewives and a new TV set. One of the housewives is a close family friend and that is how my colleague came to hear it.

This particular housewife is an old hand at TV, having owned a set almost from the inception of the service. Her friend, on the other hand, was a newcomer, having just acquired a brand new Admiral receiver. (My reason for quoting the brand will be obvious as we get to the end of the story.) Naturally, she was just as thrilled and proud of her new set as anyone else and insisted that her friend come round and see it.

APPEARANCE

So the set was duly inspected, the lines of the cabinet fussed over, its "match" with the other furniture discussed, its long position in the room queried and ultimately approved, and just about every every other aspect of its appearance considered.

Then, almost as an afterthought, the owner switched it on to demonstrate the picture. But when this appeared her visitor was shocked to observe that it was quite badly "stretched" (overscanned) vertically.

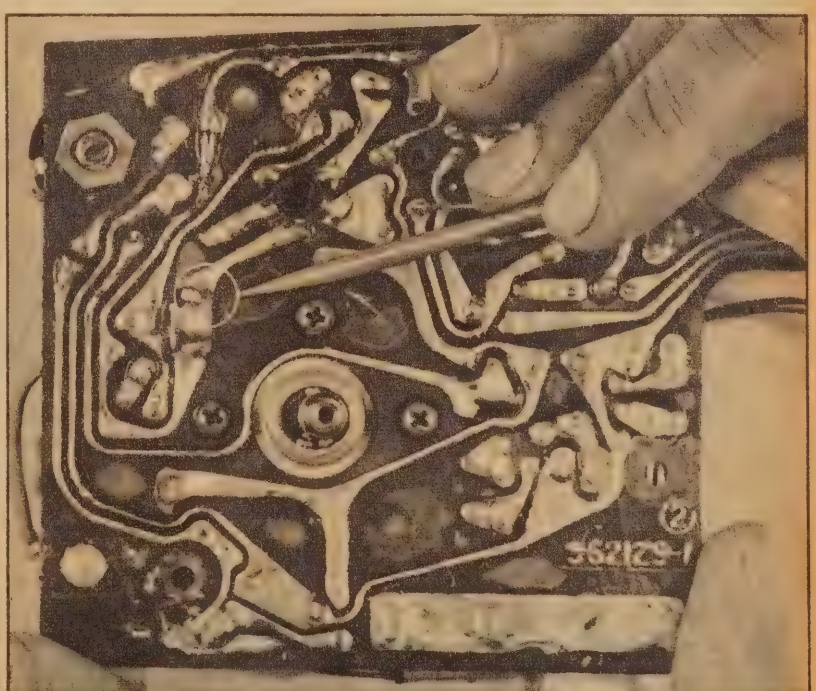
The effect was quite severe and, while it might have given some of the stouter ladies a nice slim figure, it distorted everything else in a distressing fashion. Faces took on funereal expressions, legs were unduly elongated—and sometimes chopped off—and vehicles rolled around on oval wheels. Altogether, it was a pretty ghastly effect.

NO EXCUSE

(This is the kind of sloppy installation technique I have condemned on previous occasions. The fault is seldom that of the manufacturer, but rather of the dealer who is too careless to check the various functions when the set is installed and, if necessary, adjust them.)

The effect was so bad that the visitor felt bound to mention it, even at the risk of deflating her host's enthusiasm for the new set. So, as tactfully as she could, she suggested that the set might need some slight adjustment, pointing out the thin appearance of the characters on the screen.

"Oh, that's all right," her host replied, "We wondered about that too at first, but the dealer assured us it was nothing to worry about. He explained that the pictures were supposed to look like that because it is a Slimline model."



One of the hazards of printed circuits—a hair crack too fine to be detected by visual inspection.

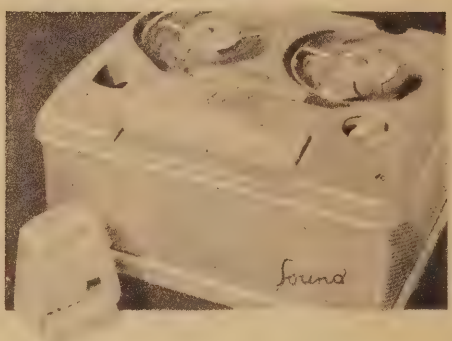
Magnetic Sound INDUSTRIES

• FOR TAPE RECORDERS •

SOUND Belle

SOUND BELLE

The lowest priced automatic Tape Recorder ever offered. Push button operation: 1½ hours' playing: Twin Track: Public Address System: Weighs only 12 lbs ---------- **53 Gns.**



NOWHERE ELSE IN AUSTRALIA WILL YOU BE OFFERED SUCH VALUES AS THOSE AT "MAGNETIC SOUND"

STEELMAN HI-FI BATTERY 2 SPEED RECORDER

Ideal for music or speech recording. Fast forward and re-wind.

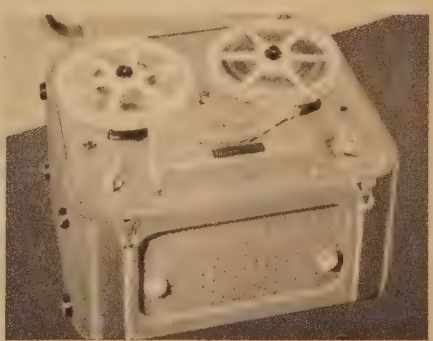
2 Tracks ---------- **£122:17:6**

GRUNDIG T.K. 24 THE ONLY 4 TRACK RECORDER IN AUSTRALIA

THE GRUNDIG T.K. 24 is the best Tape Recorder in the World! 7 hours' superb recording and playback; instant selection of any recording from 1200ft of tape; complete with microphone and tape. Automatic stop at end of tape. **ONLY £139/10/-** (FROM £14/10/- DEP.)

CLARION TRANSISTOR TAPE RECORDER

Weighs a mere 5lb; records and plays back anywhere—50 hours' recording on one set of 4 Torch Batteries; can even be used as a Public Address System. **ONLY 51 GNS.** COMPLETE (£12/10/ DEP.)



PYE — EXCLUSIVE TO US.

The latest PYE Superb 2-speed, twin-track hi-fi machine, with direct radio input for direct recording from your radio or gramophone. Also built-in Public Address System. **NOW ONLY £95** OR £10 DEP. the only recorder with a 12 months' guarantee.

HIRE A TAPE RECORDER FROM "MAGNETIC SOUND" 25/- per day

Magnetic Sound INDUSTRIES

BISLEY HOUSE,
387 GEORGE STREET
(2 DOORS FROM KODAK)
BX4440 BX4587

So there it is. It seems that the lengths to which some dealers will go to avoid even the simplest obligation is matched only by the credulity of their customers. What a pity their ingenuity in thinking up excuses could not be put to better use.

My most interesting story this month concerns a transistor set. (I need hardly add that transistor sets are increasing in number at an amazing rate. One has only to make a peak hour train journey or visit the beach on a Sunday morning in search of a little quiet relaxation in order to become acutely conscious of this fact. But that's another story.)

This set was a well-known American model brought in to the country by an overseas traveller. As such, it presented the problem—all too common these days I'm afraid — of having no local agent from whom spare parts might be obtainable. Thus, when something vital packs up, replacement can be a tricky business.

PREVIOUS ATTEMPTS

To make matters worse, someone had obviously tackled it already. In fact, as the owner delivered it to me, it consisted of a half-empty cabinet, the main printed board, and sundry minor items such as mounting screws, brackets, knobs, &c., all carried in a cardboard box. All in all, it looked like a sorry mess, at least in the owner's eyes.

As far as I could make out, the original fault was a straight-out complete failure. The first person to tackle it had been a heavy-handed character who (apparently) had ripped the board out of the cabinet without bothering to disconnect the speaker leads, mutilating the output transformer in the process. In addition, he had damaged a 1000 ohm resistor in the emitter circuit of the 2N411 converter.

A second chap to whom the owner appealed was a more gentle type. Not only did he not break anything, but he managed to patch up the damaged output transformer, and also replaced the broken 1000 ohm resistor. Unfortunately, after curing these obvious faults, he was unable to find the original trouble and so the collection of bits and pieces eventually found their way to me.

SETTING UP

I didn't really mind it being pulled down, since it saved me that much work. Nevertheless, it took me a little while to sort out its history as detailed above and get it set up to the point where it should have worked if it was going to. Naturally, it didn't.

At this stage it became apparent that a stage by stage test with suitable signals seemed the most logical way of tackling the problem. Admittedly, identifying various stages and suitable injection points is not easy in a strange printed circuit, without the benefit of manufacturer's service data of any kind. Nevertheless it has to be done regardless of how one approaches the problem.

I started with the audio section. This seemed to be functioning normally, even though the sensitivity was down by local standards. I attributed this to the fact that there was no audio stage as we know it, the detector working straight into the class B driver stage.

Next I fed 455 Kc into the front end of the IF stage. This was functioning, but also seemed low in sensitivity. This time the reason was more serious. Someone, presumably our heavy-handed friend, had been twiddling the IF adjustments, with the result that they were anywhere but where they should have been.

I spent some minutes aligning this section, resulting in a marked improvement in sensitivity. It seemed apparent that the designers had concentrated on high IF gain to offset the lack of an audio stage and, judging by performance, with a good deal of success.

My investigations so far had taken me to the output of the converter stage, suggesting that the trouble must be somewhere between here and the aerial. I tried coupling signals at broadcast frequencies into the ferrite rod, but no amount of RF strength I could muster could be forced through the set from this point.

I changed to 455 Kc. This was better, inasmuch as I managed to get some response, but it was extremely weak. There seemed little doubt that the trouble was in the converter stage, and that it wasn't "converting."

I began a more detailed examination of this part of the board, probing gently at any likely joint or component as a preliminary measure. If that didn't reveal anything, the converter transistor would have to come out and be checked or replaced.

But that wasn't necessary. Quite suddenly, as I exerted slight pressure on the board, everything came good. The 455 Kc signal jumped to a solid level and, after this was removed, I was able to tune in several local stations.

Twisting the board gently had a similar effect, and I could make the signals come and go at will with the very faintest flexing. There was either a beautiful dry joint tucked away somewhere in the system or it was the curse of all printed board servicing — the hairline crack.

CRACKS?

I went over the likely joints again but could find nothing suspicious. I decided it was time to start looking for cracks. I forced the set to work for a few minutes while I tuned in a strong local station then, being careful not to disturb the tuning, I released the pressure and allowed it to go dead again.

Armed with a short length of hookup wire I commenced a systematic process of bridging each likely printed "wire" around the converter stage. This paid off. Suddenly, as I bridged one of the leads running to the oscillator coil, the set came good, and no amount of flexing or pressure would disturb it while ever the bridge was in place.

By narrowing the distance between the ends of the bridge, and moving each one back and forth in turn, I was able eventually to pinpoint the actual crack. As I might have expected, it was in one of the few small areas on the wiring pattern where, either by accident or design, no solder had been deposited.

Yet, even though I knew exactly where it was, I had no chance of seeing it. Not until I used a moderately powerful glass was I able to pick it out. It must have been the finest hairline crack I have detected so far.

Naturally, repairs were simple enough. Some flux, solder, and a hot iron was all I needed to complete the layer of solder on the wiring pattern. After that nothing I could do would upset the performance.

Oh yes. Hairline cracks are simple — once you track 'em down.

All of which is as good an excuse as any to point out that many overseas authorities are, to put it mildly, less enthusiastic about printed boards than they were a few years ago.

When these devices were first introduced they were considered the answer to a multitude of problems. Apart from the obvious saving in space, they promised to eliminate wiring errors, put electronic equipment into the range of automation, cut costs, and generally benefit everyone all round.

PROBLEMS

Now it seems we are not so sure. While there is no doubt that they have lived up to many of the expectations, there are at least two side effects which have proved more serious than was anticipated. One is reliability along the lines already discussed (except that many faults are much more erratic and harder to find than this one) and the other is the objection which servicemen as a whole have voiced concerning the difficulty of tracing the wiring.

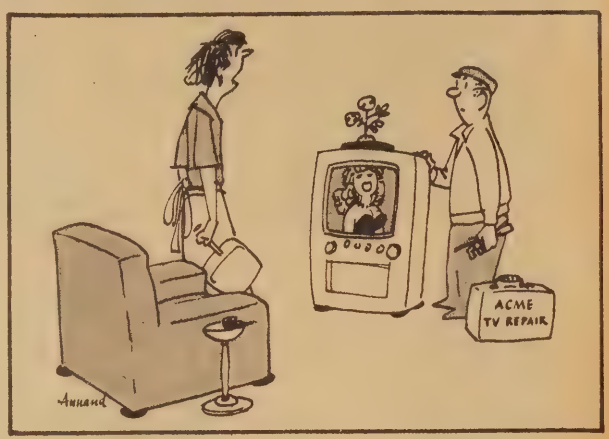
It is perhaps hard to say just how serious the reliability problem is at present but it appears to be more than a minor one. Some overseas manufacturers, specialising in high-grade equipment, are making a point of emphasising that their equipment contains no printed wiring; ". . . only high-class hand wired units used throughout, etc."

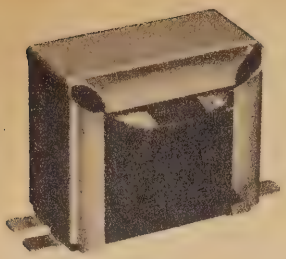
Servicemen's complaints were not treated very seriously at first, it being considered that these would cease when the strangeness wore off, and when everyone had converted their thinking to this

☆

"Is there any way you can adjust it so the girls look tall and skinny and flat-chested?"

☆





(1)

FERGUSON

MEDIUM FIDELITY OUTPUT TRANSFORMERS

OPM SERIES—40-12000 C.P.S. ± 2 db.

(2)

FERGUSON offer a complete range of reasonably priced MEDIUM FIDELITY OUTPUT TRANSFORMERS ideally suited for radiograms, record players, public address amplifiers, etc., where the use of a higher priced true high-fidelity type is not justified.

TYPE No.	NOM. POWER (WATTS)	PRIMARY IMPEDANCE (OHMS)	SECONDARY IMPEDANCE (OHMS)	MTG. STYLE
OPM1	5	S.E. 7000, 5000	15, 12.5, 8, 3.7, 3.1, 2	1
OPM19	5	S.E. 7000, 5000	500, 250, 166, 125	1
OPM20	5	S.E. 10000, 8000	15, 12.5, 8, 3.7, 3.1, 2	1
OPM2	7	P.P. 10000	15, 12.5, 8, 3.7, 3.1, 2	1
OPM3	10	S.E. 4000, 2500	15, 12.5, 8, 3.7, 3.1, 2	2
OPM4	10	S.E. 4000, 2500	500, 250, 166, 125	2
OPM5	15	P.P. 5000, 3000	15, 12.5, 8, 3.7, 3.1, 2	2
OPM6	15	P.P. 5000, 3000	500, 250, 166, 125, 100	2
OPM7	15	P.P. 10000, 8000,7000	15, 12.5, 8, 3.7, 3.1, 2	2
OPM8	15	P.P. 10000, 8000,7000	500, 250, 166, 125, 100	2
OPM10	25	P.P. 8000, 6600	15, 12.5, 8, 3.7, 3.1, 2	2
OPM9	25	P.P. 8000, 6600	500, 250, 166, 125, 100	2
OPM14	35	P.P. 8000, 6600	15, 12.5, 8, 3.7, 3.1, 2	2
OPM11	35	P.P. 8000, 6600	500, 250, 166, 125, 100, 71	2
OPM13	55	P.P. 3500	15, 12.5, 8, 3.7, 3.1, 2	2
OPM12	55	P.P. 3500	500, 250, 125, 83, 62, 50	2
UNIVERSAL TEST SPEAKER				
OPM15	10	P.P. or S.E. 10000, 7000, 5000, 2500	3.1	2
LINE TO VOICE COIL				
OPM16	10	500	15, 12.5, 8, 3.7, 3.1, 2	1
OPM17	15	500	15, 12.5, 8, 3.7, 3.1, 2	2
OPM18	25	500	15, 12.5, 8, 3.7, 3.1, 2	2

Individual data sheets on all types available on request.

Available from all leading suppliers throughout Australia

MANUFACTURED BY

FERGUSON TRANSFORMERS PTY. LTD.

411 VICTORIA AVENUE, CHATSWOOD, N.S.W. JA8491

MELBOURNE—McKINNON NICHOLLS PTY. LTD., 468 Collins St., MB1501.

BRISBANE—KEITH PERCY & CO., PTY. LTD., 179 Elizabeth St., 2-1757

ADELAIDE—TYQUIN LTD., 13 Deacon Ave., Richmond, 57-8153, 57-8154, 57-7887

PERTH—ATHOL M. HILL, Durham House, 842 Hay St., 21-6987

system. But it hasn't happened that way. Servicemen overseas are still complaining, and various refinements, such as printed diagrams and instructions—multi-coloured in some cases — have been added to the boards to try to overcome the problem.

Perhaps it is unfortunate that many of us have had to face the orientation to transistors and printed wiring at about the same time. It might well be that it is the combination which is so formidable, rather than either one singly.

Strangely enough, I have heard little real complaint locally, possibly due to the relatively few local manufacturers who employ this system. However, it remains to be seen what will happen in the next couple of years.

Personally, I think the printed board is here to stay, but it still needs a good deal of tidying up one way and another before it will justify all the claims made for it.

SPEAKER PHASING

Are the loudspeakers in your stereo system correctly phased? Does it matter anyway? This important question is discussed in this month's "Off The Record" feature.

On a completely different subject, I recently found myself caught up in a discussion concerning the characteristics of safety glass used in front of the TV picture tube. In particular, it centred around the question as to whether this glass should be "tinted" or clear.

I hasten to add that "tinted glass" in this case does not refer to the multi-coloured creations which were being hawked around the trade a few months ago and sold to the public with a lot of glib sales talk about colour TV. These seem now to have died a natural death, most people apparently realising that "Technicolor" doesn't come quite that easily.

No, "tinted" in this case refers simply to a slight darkening of the glass and, usually, with no colour at all. The correct optical description is a "neutral density filter" which is really self explanatory.

BUYING A CABINET

The discussion arose when one of my customers, who had built himself a TV set, came to the job of purchasing a cabinet. He found a suitable design all right but, when the question of the safety glass was raised, the supplier offered a choice of either clear glass or neutral density grades. And the customer, not having the slightest idea what the difference might be in practice, was completely lost.

The supplier couldn't help much, as apparently he didn't know either. All he could advise was that most people seemed to play safe and take the clear grade, though it was obvious that very few knew what it was all about.

But this customer had no intention of making a snap decision. Somewhere in the back of his mind he remembered hearing something about the supposed benefits of the neutral density glass, and he was determined to find out what it was. After all, he reasoned, if there was some benefit he might as well be in on it. So he left the matter in abeyance while he sought some advice on the matter.

Eventually he put the question to me. I say eventually, because it was pretty obvious that a lot of other people had offered their advice first, but without helping him to reach any definite conclusion. He had heard a lot about "glare" (a horribly misused term anyway), reflections, and similar effects, but very little of any definite value.

Which is not surprising really, because very little appears to have been published on this subject, at least as far as the "popular" magazines are concerned. And when I sat down to explain the story to him, it occurred to me that there must be many readers who are similarly puzzled.

So, why not write something about it?

DAYLIGHT VIEWING

The whole subject hinges around the problem of viewing TV images under conditions of high ambient lighting, particularly daylight. If we can assume that all our TV viewing can be conducted in total darkness or subdued light, then there is no problem, and a clear glass will be perfectly satisfactory.

But when we try to view in daylight the situation is quite different. Take a look at the naked screen of a picture tube in any naturally lighted workshop on a sunny day and note the colour. It may vary a little from type to type but, in general, it will appear as a light grey.

I wonder how many people realise that this very light grey presented by the unenergised screen is, in fact, the best possible "black" that can be achieved when a picture is presented? Not many probably, and it usually comes as a bit of a shock when pointed out to those who haven't thought much about it.

And I will admit that, looking at such a screen first without a picture and then with one, it may seem a little hard to believe. But it is perfectly true, because there is nothing the electron beam can do to make the screen darker, it can only make it brighter.

EYE CHARACTERISTICS

One fact which helps a little is a natural characteristic of the human eye. This tends to make any particular area look darker than it really is if it is surrounded by a much brighter area, or lighter, if surrounded by a much darker area. Many well known novelty illusions are based on this principle.

Nevertheless, in order to present all the normal steps of grey we expect to see in the picture, we have to adjust the brightness so that the very darkest portion of the picture has a brightness equal to or just below the level of light already reflected from the screen due to ambient lighting.

At least, that is what should happen. In practice, it is often difficult or impossible to achieve this without running into other complications. In general, these involve the maximum brightness we can achieve from the picture tube before we run into such problems as defocusing of the electron beam, saturation of screen brightness and a fall in EHT voltage if the regulation of the EHT supply is poor, as it generally is.

For this reason we usually settle for a compromise setting whereby we produce reasonably bright highlights, sufficient to suggest blacks by comparison.

(Continued on Page 51)

The RADIOMASTER

RADIOGRAM CHASSIS . . .

A great performer on Radio and Records

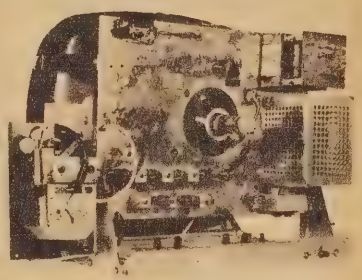
STEREO MODEL S77 gives glorious three-dimensional sound that comes from everywhere in the room. Features include dual treble, bass and volume controls, also balance control. Broadcast and short-wave radio. Seven valves. Single chassis. Two speakers.

PRICE, £36/15/-

Stereo Model S66, 6 valves £31/10/-

Packing included. Freight extra.

TELEVISION CHASSIS



21in. models from £96

RADIOGRAM — TV & STEREO CABINETS

Many popular designs are available, including combination Radio-TV-gram. All wanted colours, first-class finish.

New models for stereo incorporate speaker enclosures or we will make your stereo furniture to order. Quotations given. TV cabinets can be supplied complete with brackets and straps for picture tube mounting.

ALL TYPES OF FOUR-SPEED & STEREO RADIOGRAM UNITS

WRITE FOR CATALOGUE.

H. B. RADIO PRODUCTS

103-105 Catherine Street

Leichhardt, SYDNEY

Telephone LM5580

LOOK! SPECIAL PURCHASE!

25-Q-Plus 14" 110° TV KITSETS

AT £85'8'0

(including Sales Tax) Plus 30/- packing and freight

These **new kitsets** are complete with cabinet, safety glass, instruction manual, picture tube, all valves and components.

RUSH YOUR ORDER TODAY!

Don't miss this 'never to be repeated' opportunity to secure a quality TV receiver at **below normal cost.**

Bulk buying has made this outstanding offer possible and we expect to have available 17in and 21in kits next month.

WATCH FOR OUR NEXT ADVERTISEMENT

INTERNATIONAL ELECTRONIC SUPPLIES

649 BURWOOD RD., EAST HAWTHORN, MELB.

U R D

HI-FI STEREO SPECIALISTS

STOP PRESS!

First release . . .

GOODMANS 8" TRIAXIETTE

(Triaxiom 208)

A development of the axiette, giving you three-speaker performance in one 8" unit! Bass cone — mid-range cone — Pressure Tweeter — 3" voice coil. Frequency response of 40-20,000 c.p.s. Flux: 178,000 max. Power output: 10 watts. Resonance: 45 c.p.s. Attenuator provided.

Now AVAILABLE FROM STOCK

£32/16/9 (retail)

U.R.D. specialise in High Fidelity Stereo equipment and stock all electrical appliances, radio and TV components and parts. Hear and compare the latest stereo. players, amplifiers and speakers in our modern showrooms.
Write, telephone or visit—you'll find the service prompt and the advice helpful at U.R.D.

U R D

UNITED RADIO DISTRIBUTORS

175 Phillip Street, Sydney. BW 3718, BW 3926

However, a more critical examination of the picture will show that much of the gradation in the shadow areas has been lost, due to the absolute blacks being so far below the level of light reflected from the screen.

Summing up, we may say that the problem boils down to one of making the screen as dark as possible initially, regardless of ambient light, so that we will have a reasonable basis on which to establish our blacks. Anything which does this must help in achieving a good picture.

One method which has been suggested — and, I believe, tried overseas — is to produce a dark phosphor, i.e., a phosphor which is physically dark in its unenergised state, but which emits light in the usual way when energised.

Assuming such a material to be a possibility, and that it would not compromise performance in any other way, it would seem to be the complete answer. However, those produced so far do not seem to have achieved much popularity, so there is probably a "catch" somewhere.

A HELP OR NOT?

And what of the neutral density filter. Does it really help, or is it just a fad?

Well, I can assure you that it does help, and that it is no mere fad. In fact, the whole explanation can be stated in precise—and quite lengthy—scientific terms for those who are interested. However, it is possible to present a much simpler explanation in quite general terms.

Assuming the picture tube is mounted in a cabinet in the usual way, the only ambient light which can reach the screen must pass through the safety glass. Then having been reflected from the screen, it must pass through the safety glass again on its way out to impinge on the viewer's eye.

Thus, the light which finally emerges has been reduced twice by the same factor. To take a simple explanation, let us assume that the glass has a transmission factor of .5, i.e., that only half the light which reaches one side of the glass emerges from the opposite side. In these circumstances, half the original ambient light will reach the phosphor screen and of this (assuming 100 per cent reflection) only half will reach the viewer, making an ultimate value of only one quarter. The effect is to make the screen look quite dark.

PICTURE LIGHT?

(The assumption that the screen reflects 100 per cent of the light will not be true in practice, but does not affect our reasoning in general terms.)

And what about the light generated within the screen itself and representing the picture? This, of course, is where we "score," because this light has to pass through the neutral density glass only once, and so will be reduced by only 50 per cent.

Fairly obviously, the screen brightness will have to be increased to allow for this loss, but, assuming it does not have to be carried to extremes and thus introduce the problems already mentioned in this regard, it is a perfectly satisfactory arrangement.

As a matter of fact, a good deal of research has been devoted to this problem, and precise figures can be stated for the best compromise between all the conflicting factors, and also to indicate the order of improvement likely to be effected in any set of circumstances.

Before going any further, it is important to point out that this idea is already carried out in part before the safety glass is fitted. The picture tube manufacturers invariably incorporate some neutral tint in the face plate, so that the phosphor looks a good deal darker than it really is.

A generally accepted figure for the overall transmission factor is about .5. Of this, .75 is usually provided by the tube manufacturer in the face plate, leaving it to the set manufacturer to provide another .75 in the safety glass. Under typical adverse ambient light conditions this can improve the contrast ratio by two to one, without calling for abnormally high orders of picture tube brightness.

And, believe me, one needs every bit of this improvement in many cases, particularly in some modern house designs where the lounge-room consists of three glass walls and a couple of skylights! That is, unless one can afford a fortune for drapes and blinds to cover up the glass, in which case it might have been better not to have it in the first place.

But then, one must be modern, mustn't one?

PRACTICAL HOME-STUDY
COURSE IN RADIO

STOTT'S Course meets the exact needs of Amateurs, Radio Salesmen, Experimenters, Dealers, Service Men, Builders of Sets and others.

This Popular Course has been designed and prepared by Experts.

A N.S.W. Student wrote:—

"The lessons are simply explained and anyone, without any knowledge of Radio, can follow them quite easily."

Write today, without obligation, for particulars of the STOTT Course in RADIO FOR AMATEURS.

Stotts Correspondence College

159 Flinders Lane, Melbourne: 149 Castlereagh St., Sydney: 290 Adelaide St., Brisbane: 21 Grenfell St., Adelaide: 254 Murray St., Perth.

CUT HERE AND POST

To STOTT'S: Please send me, free and without obligation, full particulars of your Course —RADIO FOR AMATEURS.

My Name .....

Address .....

Age ..... (R.H. 660)

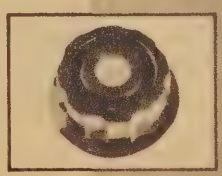
NEW JABEL PRODUCTS

JB1

Precision Vernier Drive, giving smooth, positive 10:1 reduction. ¼" shaft to ¼ drive.

JB2

Three inch skirted instrument knob with finger-grip flutes. ¼" or ⅜" bore, metal insert, 2 grub screws. 4 tapped holes permit attachment of dial plate or cursor.

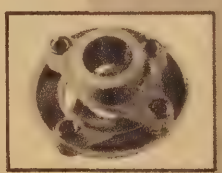


JB3 (NOT ILLUSTRATED)

Four inch Satin chrome dial with index. Calibrated 0-100 over 180°. Can be attached to JB2 for direct drive or to "driven" shaft of JB1.

JB4

Insulated flexible coupling — brass inserts and twin grub screws. Alkathene suspension. ¼" to ¼": ¼" to ⅜": ⅜" to ⅜".

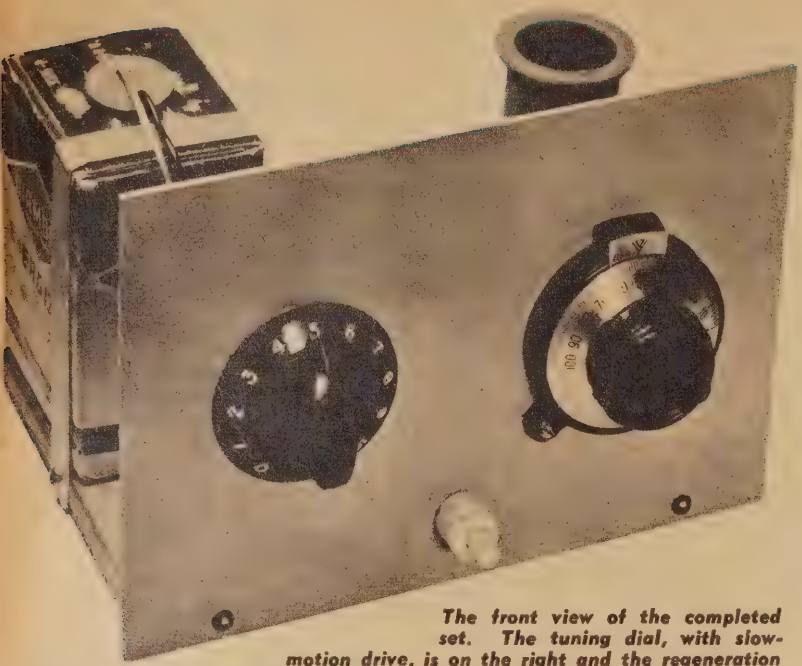


C2

Micro Vernier dial 2" diameter, graduated scale—8:1 reduction drive to ¼" bore. Black and Chrome finish.

FROM RADIO SUPPLY STORES EVERYWHERE

Inserted by Watkin Wynne Pty. Limited, Crows Nest, N.S.W.



The front view of the completed set. The tuning dial, with slow-motion drive, is on the right and the regeneration control on the left. The battery switch is in the centre, but could be made part of the regeneration control if a suitable switch pot. combination is available.

Simple, All-Wave Transistor Set

This article is intended for our younger readers and for beginners in general. It tells how, for a comparatively small outlay, those with limited experience can build themselves a simple, short-wave transistor set. Although new in the way of transistor sets, it is a simple enough project for anyone wanting to get started in radio as a hobby.

ADMITTEDLY, it is a little more ambitious than the humble crystal set on which many beginners cut their teeth, but we can see no reason why anyone with normal intelligence cannot make a success of it. On the other hand, if you have already made a crystal set or something similar, this is still a unique project.

PROGRESS

Transistors have made tremendous strides in the 10 years or so since their first tentative appearance in laboratories, and even greater progress in the mere five years since their first appearance on the Australian market.

We well remember how, in 1955, we tried to flog a humble OC70 into reliable oscillation on the broadcast band. Unfortunately, performance was too erratic for us to give the idea our blessing, but it did give us a taste of things to come. A transistor which would oscillate reliably would mean, among other things, a regenerative transistor receiver; one of the simplest sets known, made even simpler.

Nor were we disappointed. It wasn't long before more suitable types appeared and our simple regenerative set was no longer a dream. After that, as more and more types appeared, we were able to offer our readers an increasingly wide variety of circuits to try.

by Philip Watson

As well as the regenerative types for the beginner, we have described conventional six and seven-stage superhet portables, experimental four-stage superhets, and even a very effective model-train control system in the April issue.

As we fully expected, the simple regenerative sets have been just as popular with the younger generation — and some of our older beginners too for that matter — as were the valve counterparts of a generation ago. This is not really surprising, since such sets have always been notable for performance, for simple circuitry and low cost. This last is a vital factor for the beginner on a schoolboy budget.

Transistors have made such sets even more attractive. While the transistors themselves may be a little dearer than the valves they replace, this is usually more than offset by the simpler power supply requirements.

POWER SUPPLIES

A valve requires a heater and HT supply, either from batteries or a power supply operating from the mains. Batteries can represent a considerable first cost, while the current drain, particularly in the heater circuit, can be substantial. A power supply, while a better proposition in many ways, may still cost nearly as much as the first set of batteries, while there are many parents who hesitate to approve the use of such supplies in experimental hookups.

The transistor suffers from none of these problems. It's power requirements are so modest that it will run for months on a battery costing only a few shillings. Thus first cost is reduced and, because running cost is so low, there is no temptation to abandon batteries in favour of a mains supply.

Parents who previously hesistated to encourage youngsters in a worthwhile hobby are quickly assured when nothing more lethal than a nine volt battery is involved.

So far there has been but one catch. Apart from a few very high priced units, the readily available transistors were not suitable for use at frequencies much above the broadcast band. For all practical purposes short-wave operation was "out," thereby denying the beginner one of the most interesting and satisfying aspects of small set operation.

BETTER TRANSISTORS

But this frequency barrier is being slowly broken down, both technically and economically. Whereas high frequency transistors have previously been scarce and high in price, the situation is improving almost daily, as manufacturers find new and better designs and methods of production.

Typical of these advances are the "drift" transistors, and the types 2N370, 2N371, and 2N372, currently available on the Australian market. While not the utlimate in this type (they can operate

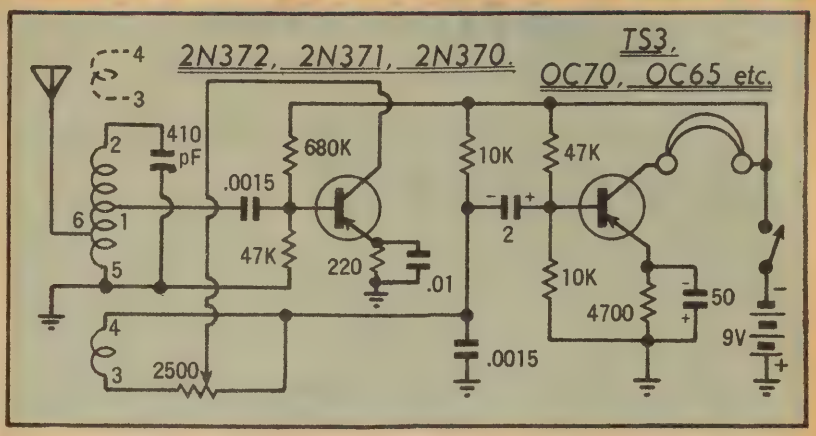
PLUG-IN COILS COVER 4 BANDS

at several hundred Mc), they will work into the 20 Mc region and cost only about £2/11/ retail, a very attractive price compared with many "broadcast band only" types available in the past.

And so our simple short-wave transistor sets become a practical possibility, and at very little more cost than that of similar broadcast type sets, which we have described in the past. And, since it is no hardship to retain the broadcast band as well, it also makes an ideal bedside set when you wish to relax with your favourite local program.

Although we are presenting this as a complete constructional article for the beginner, it also should appeal to those who have built some of our previous transistor projects.

In particular, those who built the one, two, and three stage circuits of December, 1958, and January and March, 1959, or the one and two stage sets of June and July, 1957, will recognise the similarity of the circuits, and may use this article as a guide to convert their existing sets. We may even describe the addition of a third stage to this set in a later article.



Many readers will recognise the similarity between this circuit and our previous simple transistor sets. Main difference is the detector transistor type and some component values which give better short-wave performance. Note the pin numbers on the coil diagram.

CIRCUIT POINTS

In the meantime, discussion of a few points about the circuit may help the beginner to get a better idea of what it is all about. The heart of the circuit is the regenerative detector built around the 2N272 transistor. (The 2N372 is officially designated as a mixer, but the 2N370 or 2N371 — RF amplifier and oscillator respectively — should operate equally well in this circuit.)

Signals picked up by the aerial system are fed to the main tuning coil via a suitable tapping. The coil, in conjunction with the variable capacitor connected in parallel with it, forms the tuned circuit with which we select the signal we wish to receive. The range of this capacitor is not critical, but the standard type covering from about 20 to 400 pf is a logical choice.

By using "plug-in" coils we can select the range of frequencies over which we wish to tune by simply selecting the required coil and plugging it in. The range of the capacitor is large enough to cover the broadcast band in one sweep, and we can cover as much of the short-wave band as we are likely to want with three other coils, making four in all.

TAPPED WINDING

Those familiar with valve circuits may note that the method of coupling between the tuned circuit and the detector transistor is a little different. Whereas, in a valve circuit, we connect the whole of the tuned winding between the grid and cathode, this circuit connects only part of the winding between the emitter and the base. (The emitter and the base correspond roughly to the cathode and grid in a valve.)

This arrangement highlights a fundamental difference between the valve and the transistor. The valve has a very high input impedance and, even when functioning as a leaky grid detector, may be connected to a high impedance source of signal (the tuned circuit in this case) without loading it too seriously.

The transistor has a relatively low input impedance and is operated by signal current rather than signal voltage. Thus the signal source also must have a low impedance, and the easiest way to provide this is connect the transistor across portion of the coil only.

About the easiest way to visualise the operation of the detector is to consider —for the moment—that the transistor consists of only the base and emitter sections. As such, it resembles a diode rectifier such as might be used in the simplest crystal set. Its function is simple: it allows current to flow more readily in one direction than in the other, a process which most of us know as detection.

COLLECTOR CURRENT

But this current flowing between the emitter and base regions will have a marked effect on current flowing between the emitter and collector regions. In fact, this is the basic principle of transistor amplification; a small current change in the emitter/base circuit will cause a very much larger change in the emitter collector circuit.

So, while our signal currents are being detected in the emitter/base circuit, they are also being amplified in the emitter/collector circuit. If we were to connect a pair of headphones in the collector circuit we would be able to hear the audio information used to modulate the original transmission. And, since our transistor is an amplifier as well as a detector, the signals would be a good deal louder than we would obtain from a simple crystal set.

RF AMPLIFICATION

But we are not finished treating our signal yet, even as far as this first stage is concerned. The collector circuit contains, in addition to the audio signals already mentioned, RF signals originally present in the tuned circuit. What is more, assuming the transistor is capable of amplifying at this radio frequency, these signals will also be amplified.

The next thing is to find a use for this amplified RF energy. The idea of using it "over again" (regeneration) is one of the oldest tricks in radio—and one of the most successful. It can increase the selectivity and sensitivity of a simple detector stage by a very high

1 metal panel 7in x 5in
1 wooden baseboard 6½in x 4½in
1 small slow-motion dial
1 pointer knob and scale
1 6-pin valve socket
4 6-pin, 1½in coil formers
1 9-volt battery
1 battery plug to suit
4 terminals
1 7-tag terminal strip
1 8-tag terminal strip
1 battery switch (Optional, see potentiometer).
1 pair high resistance headphones

TRANSISTORS
1 2N372, 2N371 or 2N370
1 TS3, TS2, TS1, OC70, OC71, OC65 or OC66.

CAPACITORS
1 50 mfd 12VW electro
1 2 mfd 12VW electro
1 .01 mfd 200V paper
2 .0015 mfd ceramic
1 tuning capacitor approx. 10-400 pf.

RESISTORS (All ½W)
1 .68M
2 47K
2 10K
1 4700 ohm
1 2500 ohm linear switch pot (Switch optional).
1 220 ohm.

MISCELLANEOUS
6 1in x ¼in whit. RH brass screws, Nuts, solder lugs, hookup wire, coil winding wire, etc.

THE WARBURTON FRANKI PAGE

BARGAINS RADIO PARTS

• **RECORD PLAYERS—"Dual"** Superseded model 295 in original carton Normally £18/10/, few to clear £14/10/. Freight forward.

• **SPEAKERS** Superseded models—Famous make in original cartons. 8in, 47/6; 10in, 52/6; 12in, 59/6. Voice Coil impedance 2.7 ohms. Transformers available all impedances at 25/ each. (All above Post and Packing, 3/6).

• **P.A. SYSTEM** Complete including 4 watt Amplifier, 8in Speaker in leatherette box and Crystal Microphone. **Price,** ready to use with all connecting wires, plugs, etc., £27/10/. Freight forward.

• **PICKUP CARTRIDGES** Crystal Turnover type, complete with L.P. and Std. Stylii as used in Collaro Record Changers and Players, 37/6 each. Packing and Posting, 1/.

IMPORTED MULTIMETERS

Ranges: D.C. Volts 0/10/250/500/1,000. A.C. Volts: 0/10/250/500/1,000. D.C. Current: 0/1/250 mA. Resistance: 0/10/ 100K ohms. Sensitivity: 1,000 ohms per volt.

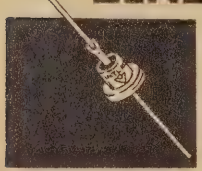
Packed in Box with Test Leads and instructions, 89/6. Packing and Postage, Vic. 1/10, int., 3/.

• **SAPPHIRE STYLII**
Type 16 for Acos HGP37 Cartridges.
Types 17 for Collaro and Rorette Cartridges.
Type 18 for Garrard Cartridges.
Type 35 for B.S.R. cartridges.
Price 7/6 each. Post free.

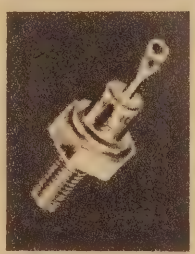
• **SPEAKER FIELD COILS**
1,500, 2,000, and 2,500 ohms D.C. Resistance, 2/11 each. Post, and Packing, 1/.

"INTERNATIONAL RECTIFIER"

ZENER DIODES



W.F. are able to supply from stock 1 watt, 3.5 watt, and 10 watt Silicon Zener Diodes. Zener Voltages from 3.9 through to 15 volts. Higher voltages on indent.



ZENER DIODES

1Z Series 1 watt, £1/7/6 ea. 3Z Series, 3.5 watt, £1/19/6 ea. 10Z Series, 10 watts, £3/7/6 ea.

152 STANDARD SILICON VOLTAGE REFERENCE DIODES

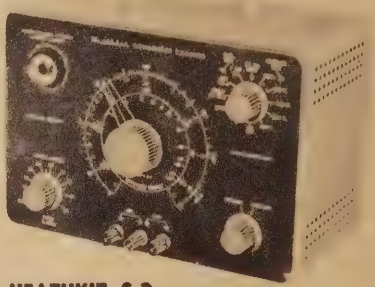
LISTED BY THE STANDARD RETMA DECADE SYSTEM

Zener Voltage Range	Voltage Steps Available	Standard Tolerance and Code	Very Close Tolerance and Code
3.9 through 6.1 v.	0.1 volt steps	plus-minus 5% (T5) plus-minus 10% (T10) plus-minus 20% (T20)	plus-minus 0.1 volt (VO1)
6.26 through 15.75 v.	0.25 volt steps	plus-minus 5% (T5) plus-minus 10% (T10) plus-minus 20% (T20)	plus-minus 0.25 volt (V25)
16 through 29.5 v.	0.5 volt steps	plus-minus 5% (T5) plus-minus 10% (T10) plus-minus 20% (T20)	plus-minus 0.5 volt (VO5)

HEATHKITS

BUILD YOUR OWN ELECTRONIC INSTRUMENTS

EASILY—QUICKLY—INEXPENSIVELY



HEATHKIT C-3

CONDENSER CHECKER KIT

Check unknown condenser and resistor values quickly and accurately as well as their operating characteristics with this fine instrument. Capacity measurements are made in four ranges: .00001 mfd — .005 mfd; .001 mfd — .5 mfd; .1 mfd — 50 mfd; and 20 mfd — 1,000 mfd. Measures resistance from 100 ohms to 5 megohms in two ranges. All values read directly on the calibrated scale. An electron beam "eye" tube indicates balance and leakage. Leakage test provides switch selection of five test voltages, 25 volts to 450 volts DC. Spring return test switch eliminates shock hazard to operator by automatically discharging condenser after test. For safety of operation the circuit is entirely transformer operated. £17/5 plus S.T.

HEATHKIT 1A-1

ELECTRONIC IGNITION ANALYSER

Ideal for use on automobiles, boats, aircraft engines, etc., this easy-to-build instrument makes it possible to check the performance of an ignition system without removing engine parts. The 1A-1 will check the dynamic performance of ignition systems with the engine in operation (400 to 5,000 R.P.M.) The waveform produced on the picture tube is affected by the condition of the coil, condenser, points, plugs, and ignition wiring, so it can be analysed, quickly localising any defect. Shows complete engine cycle, or just one cylinder at a time. £55 plus S.T.

WARBURTON FRANKI

359 LONSDALE ST., MELBOURNE — MU 8351

OPEN SATURDAYS MORNINGS. TRADE ALSO SUPPLIED.

order, so much so that simple two and three stage receivers can compete with their big brothers in all but the more exacting tasks.

Regeneration uses the amplified RF energy by coupling it back into the tuned circuit from whence it came, making sure that it is so phased that it will assist this original signal. Referring to our circuit, the feedback winding may be seen at the bottom of the tuned winding and forming part of the collector circuit.

One of the easiest ways to visualise what happens is to consider the efficiency of the tuned circuit. This can be made quite high by careful coil design and attention to other details, but it will never reach 100 p.c. A completely "lossless" tuned circuit would be on a par with frictionless bearings, perpetual motion, and so on. We must assume that there always will be some losses, and that these will detract substantially from our signal strength.

CANCEL LOSSES

However, we can produce the equivalent of a lossless circuit. If we feed into the tuned circuit enough amplified RF energy to make good the losses, so that the signal is as strong as it would be in a hypothetical lossless circuit, then, for all practical purposes, the losses cease to exist.

In practice, we cannot carry this idea quite that far. If we overcome all our losses the system will become unstable. The tuned circuit will commence to oscillate on its own account, at its own natural frequency, and will continue indefinitely while ever we feed power to the system.

Except in special circumstances, such a condition is quite unsuitable for proper reception. However, if we reduce the amount of feedback to the point where it just fails to cancel all the losses—but still cancels most of them—we will have an extremely efficient circuit, but one which is also quite stable. In this condition it will increase the sensitivity many times.

As may be appreciated, the amount of feedback is quite critical; it must be just so much, no more, no less. Since many factors affect it, it must be under the control of the operator, and the operator must acquire some skill in exercising this control. There are various ways of controlling feedback, but in circuits of this kind, a potentiometer shunted across the feedback winding is a very convenient one.

SELECTIVITY

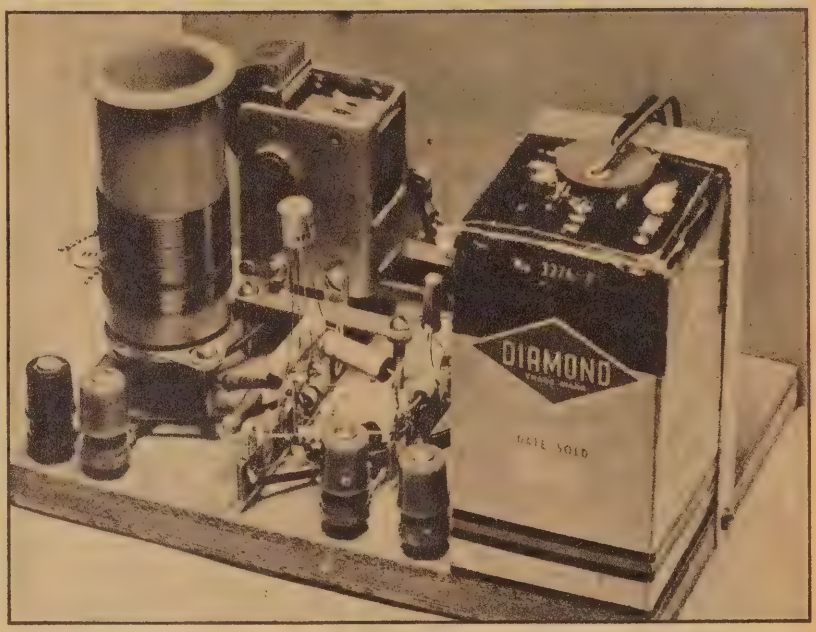
And, finally, there is the question of selectivity, and the effect which regeneration has upon it. Since the signal in the collector circuit has been "selected" by the tuned circuit, it will be strongest at the wanted frequency. When this is fed back, the cancellation of losses will be most effective at this frequency, so that the improvement in performance occurs almost exclusively at this frequency.

The result is a very marked improvement in selectivity, a factor which is every bit as important in a simple set as is the improvement in sensitivity.

Considering our detector circuit in more detail, and particularly for the benefit of those who have made previous similar sets, it will be noted that some small changes have been made. One concerns the value of forward bias resistor which was previously about 2.2M. Since this bias is to some extent a compromise between the requirements of detection on the one hand and amplification on the other, the final value is best determined experimentally.

While the higher value worked well enough on the broadcast band, it was not completely satisfactory at the higher frequencies, both in regard to output and reliability of regeneration. This appears to be due in part to the characteristics of the 2N372, and in part to the need to maintain good amplification characteristics at the higher frequencies. We finally selected a resistor value of .68M, but it may be possible to raise this to 1M in some cases.

A REAR VIEW OF THE RECEIVER



This picture gives a good idea of the layout and shows most of the components. The 2N372 is nearest the coil, the TS3 nearest the battery. Aerial and earth terminals are on the left, the phone terminals on the right. Note the mounting of the tuning capacitor and coil socket.

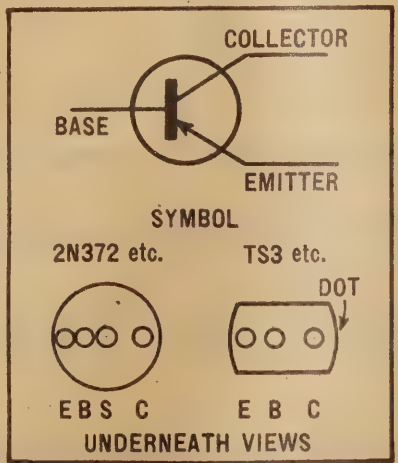


Diagram showing the transistor connections. The collector is either marked or spaced away from the other leads. Note the extra (shield) lead ("S") on the 2N372. Watch connections carefully or transistors may be damaged.

Another factor governing regeneration concerns the 220 ohm emitter bias resistor for the 2N370. In theory, at least, this should be by-passed, if degeneration is to be avoided, but we have omitted this in some previous circuits since the improvement was negligible and the cost of the extra component therefore hardly justified.

As far as audio gain is concerned this is still true, but an RF by-pass is virtually essential in order to ensure reliable regeneration at the higher frequencies.

Another refinement concerns the regeneration control. This has been wired somewhat differently, the change being one we tried in the "Transporta Four" (October, 1959) and which proved to give somewhat better control. We have also reduced the value of the pot., once again in the interest of better control on the high frequency bands. Regeneration can be quite critical here, and too high a value crowds the working area into too small a movement.

AUDIO STAGE

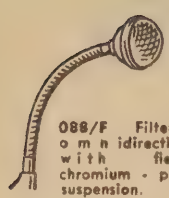
The audio stage is quite straightforward, and uses what is now regarded as fairly standard circuitry. We used a TS3, but there are several other types which may be used if available. The TS1, TS2, OC70, OC71, OC65, OC66, and similar types may all be used without circuit change.

The TS3 might be slightly better in this role than the others, although the difference is not likely to be staggering. On the other hand, the TS1 is an ideal companion for the 2N185 in an output stage, assuming a three stage receiver is contemplated later on.

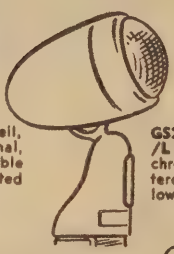
The circuit as shown is designed for use with standard high impedance headphones (2,000 to 4,000 ohm types). If

A MICROPHONE FOR EVERY PURPOSE

AWA carries a complete range of Ronette Crystal and Resio microphones and accessories for your every need!



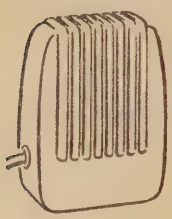
088/F Filtercell, omnidirectional, with flexible chromium-plated suspension.



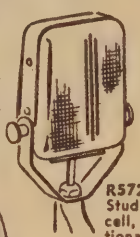
GS210 & GS210-/L Streamlined chrome finish, filtercell, high or low impedance.

44 Hand or desk mounting, counter-balanced base, ivory plastic housing.

C53 Hand or stand, omnidirectional, black plastic housing, and hand-grip.

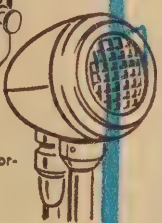


HM7 Hand or stand microphone, filtercell, robust die-cast housing, attractive finish.



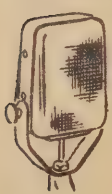
R572 & R572/L Studio type, duo cell, omnidirectional, high or low impedance.

R474 Studio type, 4-cell, omnidirectional



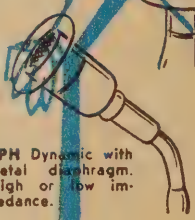
B110 Plastic torpedo form.

S472 Dual cell omnidirectional, suitable for cable suspension.



RFC5 & RFC5/L. Filtercell, semi-directional, high or low impedance.

RBH/T Ribbon velocity, available high or low impedance.



DPH Dynamic with metal diaphragm. High or low impedance.

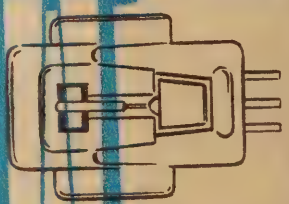
AWA RONETTE PICKUPS & CARTRIDGES

Wide range p/u turnover heads type FF2 and FF3. Type FF22 stereo

TX-88 wide range.

Turnover p/u cartridge TO-284/OV; TO-284/P; TO-284/T; TO-284/TX; TO-284/PX.

Stereo TO-OV



BF40—wide range stereo cartridge

PUBLIC ADDRESS MICROPHONES

Marketed and guaranteed by

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

● 554 PARRAMATTA ROAD, ASHFIELD. UA0791. ● 167 QUEEN STREET, MELBOURNE. MU9161.
● CNR. WILLIAM AND NEWCASTLE STREETS, PERTH. 21-5945.

Available in other states from:—
NEWTON McLAREN LTD., ADELAIDE ● CHANDLERS PTY. LTD., BRISBANE. And from leading wholesalers.

low impedance types are available they may be used, but we suggest the circuit be modified as shown in the January, 1959, article, page 43. (Copies available if required.)

Simple sets of this kind are not particularly critical in regard to layout, so the final physical form which it takes is largely a matter of personal choice. In most cases, the builder probably will be guided by the tools and metal working facilities he has available.

It may be built on a small aluminium chassis and front panel if one feels competent to tackle the small amount of bending and cutting involved, and this makes a very nice job. We used an even simpler arrangement, a wooden baseboard and an aluminium front panel. A little ingenuity is required to mount some of the components, but it still makes a very simple setup.

BASEBOARD

The baseboard may be made from ¼in or ½in solid core or plywood, and measures 6½in by 4½in. The panel measures 7in by 5in. A metal panel is necessary to act as a shield, particularly on shortwave, where the presence of the operator's hand may affect the tuning of the set. This little set is markedly free from any "hand capacity" effect.

If you feel inclined to use a metal chassis there is no reason why this should not be done. It may have the same dimensions as the baseboard and a depth of about 1½in. This latter will fit in with the existing panel layout. The minor components, including the transistors, would then be mounted on the underside of the chassis.

All the components are standard commercial items which should be readily available from your regular dealer. The dial is a Japanese type and is a nice unit at a reasonable price. Watkin Wynne Pty. Ltd. are the local agents. This firm also supplied the knob and scale for the regeneration control, although the scale is not strictly essential.

We originally planned a combined pot. and switch for the regeneration control and battery switch, but the value we required made this rather awkward. We settled for a separate switch, and this may be any normal type which will fit in the available space.

The tuning capacitor and coil socket need to be mounted above the baseboard. We used ¼in brass machine screws tapped directly into the wood. This may sound a little unconventional, but it is quite practical where no extreme stress is involved. The components are supported on nuts fitted to the screws before the latter are screwed into the baseboard. One inch long screws are used, and 3/32in tapping holes are drilled in the baseboard to take them.

ALTERNATIVE MOUNTS

Alternatively, wood screws may be used with tubular spacers to support the components. Small wood screws also may be used to mount the smaller components on the baseboard. The terminals are screwed directly into the baseboard after being fitted with a nut and solder lug. Solder lugs also should be fitted to the tuning capacitor assembly to facilitate "earth" connections to the panel and the circuit generally.

If the coil pin numbers given in the circuit are to be retained, the coil socket is best mounted with the two larger pins facing in the general direction of the headphone terminals. This will provide the most logical lead arrangement.

The transistors and minor components are mounted on two terminal strips screwed to the baseboard. The one nearest the coil is a 7-terminal type and the other an 8-terminal type. Both transistors are mounted with their collector connection nearest the rear of the board.

In the case of the 2N372, the shield connection (S) connects to the centre (earthy) tag on the terminal strip. Each strip supports most of the minor components associated with the particular transistor, with a few cross connections to complete the circuit.

BE CAREFUL

As mentioned in previous articles, care should be taken when soldering transistor leads, as excessive heat can damage the transistor. Leave the leads uncut, and hold them with a pair of long-nose pliers between the transistor and the joint to minimise heating.

The coils are wound on 1¼in diameter, 6-pin formers, and most of the data is included in the coil table. The gauge of wire is not critical within reason, but watch the space required for the broadcast band. Except for the highest frequency coil, each has two windings, the tuned winding and the feedback winding, the latter being the lower and smaller of these.

The tuned winding is tapped as indicated in the coil data, one tap being used for the aerial connection and another for the base. The best ones for each must be found experimentally, but in general the first tap appears best for the aerial and the third or fourth tap for the base.

Taps may be made by twisting a loop in the wire at the appropriate turn (one really needs a third hand here), or by sliding a piece of matchstick under the winding to raise it slightly above its neighbours. Once the best taps are found for each coil they may be connected permanently to the appropriate pin.

The actual former and socket connections used do not matter, so long as the correct connection is made into the circuit. However, the circuit shows the numbers we used, just as a guide.

The highest frequency coil differs slightly from the others. Due to the small tuned winding, it was difficult to tap this effectively for the aerial connection, and we decided to fit a separate aerial winding. The feedback coil is now mounted above the tuned winding, the connections being the same as before, i.e., the bottom of the winding to pin 3, top to 4. (Dotted winding in circuit.)

The aerial winding uses the pin previously used for the aerial tap (No. 6) and the existing earth pin used by the tuned winding (No. 5). Thus the socket takes care of the two-coil arrangement automatically. It should be noted that there is plenty of room for experiment in the matter of coils, those we produced merely serving as a guide; so don't be afraid to add or subtract a few turns to suit a particular requirement.

With everything wired and checked, plug in your first coil (we suggest the broadcast band for a start) and switch on. There should be a definite noise level or "rushing" sound, which is a healthy sign. Advancing the regeneration control should produce a fairly sudden increase in noise as the set goes into oscillation, and tuning over the dial should reveal some stations.

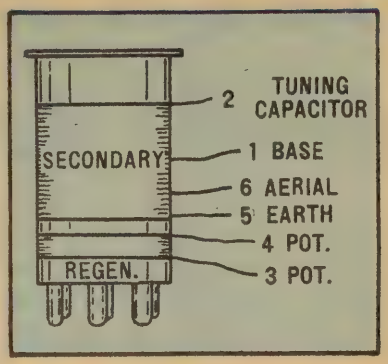
It is vitally important that the set be capable of oscillating. If not, signals will be weak and very broad on the broadcast band, and probably non-existent on the shortwave bands. In this event, check carefully the connections to the feedback winding. If in doubt, try reversing them, since one of the two possible connections must be right.

OPERATING POINT

Do not leave the set in oscillation (it can interfere with other receivers), but back off the control until it is operating just below this point and tune for strongest signals. There will be some interaction between the tuning and regeneration controls, but a little practice will cope with this. Particularly on the broadcast band it may be necessary to prune the aerial length to give the best selectivity consistent with signal strength.

Both tuning and regeneration will become more critical as the frequency increases, so more care is needed in handling the controls. Once again, practice will soon make the user familiar with all the little tricks of shortwave listening.

COIL DETAILS



Winding arrangement for all coils except 10-20 Mc band. Numbers refer to circuit coil numbers, and are also suggested pin numbers.

BAND	PRIMARY	SECONDARY	TAPS	REGENERATION
B/CAST	—	110	10-20-30-50	30
2-5 Mc	—	25	3-6-9-12	8
4-12 Mc	—	10	1-2-3-5	4
10-20 Mc	2	3	1.5	4

All windings in the same direction. Spacing between all windings, ¼in. Broadcast coil wound with 28 B & S gauge. All others, 22 B & S gauge. In the case of the 10-20 Mc coil, the primary is wound below the secondary, the regeneration winding above the secondary.

NOW AVAILABLE IN AUSTRALIA!

HALTRON VALVES

R. W. Steane Limited announce their appointment as Australasian Agents for **Haltron Valves.** These guaranteed first quality valves are supplied to many **Government Departments** all over the world including **U.S.A., Great Britain and Australia** and facilities are available to carry out testing to comply with **Air Registration Board Approval** in addition to **JAN, MILE, C.V.** and **Armed Forces Specifications.**

We have access to **1,000,000 valves of over 800 types** and can arrange for immediate **Jet Air Freight** on request at an additional cost of approximately 1/- per valve.

Large stocks of wanted types are now available and in transit. Please contact us at your earliest convenience so that we may provide you with **immediate delivery** from our stocks. Should you require specialised types we would be happy to quote price and delivery information on application to our Head Office.

R. W. STEANE LIMITED

Head Office and Factory: Melbourne: 2a Montrose Street, Hawthorn, E.3. (WB3377-8-9).

BRANCH OFFICE—SYDNEY: 8 CADOW STREET, PYMBLE (JX3556).

Agents:	ADELAIDE	BRISBANE	PERTH
	WM. T. MATHEWS LTD. W7021.	KEITH PERCY & CO. PTY. LTD. 2-1757	H. J. McQUILLAN PTY. LTD. BA8911

ACOS REPLACEMENT CRYSTAL CARTRIDGES

GP37-1C
Standard replacement crystal turnover Cartridge for most record changers. Now replaced by GP65-1G.
PRICE:
Twin Sapphire Styli, £2/18/6.
Sapphire/diamond Styli, £4/19/6.

GP65-1G
Crystal turnover Cartridge, standard ½" mounting bracket. Improved GP37 performance.
PRICE:
Twin Sapphire Styli, £2/18/6.
Sapphire/diamond Styli, £4/19/6.

GP67-3G
High gain turnover crystal Cartridge, suitable for reproducing standard and micro-groove recordings with low gain amplifier.
PRICE: Twin Sapphire Styli, £2/3/-.
Sapphire/diamond Styli, £4/4/-.

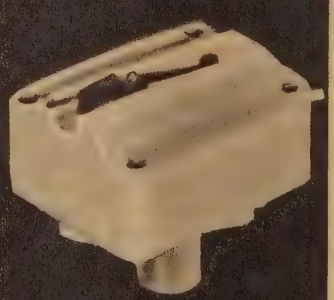
GP61
Turnover ceramic Cartridge. Unaffected by heat or humidity. Specially designed for tropical areas.
PRICE:
Twin Sapphire Styli, £2/18/6.
Sapphire/diamond Styli, £4/19/6.

HGP39
Crystal Cartridge. Available for standard or L.P. recordings for use with HGP20 and HGP40 Pick-up Arms.
PRICE:
Single Sapphire Stylus, £3/12/6.
Single Diamond Stylus, £5/13/6.

ACOS STEREOPHONIC CARTRIDGES

GP73 Series
Turnover stereophonic Cartridge, plays all types of recordings. GP73-2 Medium output. GP73-5 High output. Available with standard ½" mounting bracket (type A), or special mounting bracket for end mounting (type B).
PRICE: Twin Sapphire styli, £3/6/-. Sapphire/diamond Styli, £5/16/6.

GP71 Series
Cartridge plays stereo and L.P. recordings, non-turnover type.
PRICES: GP71 with sapphire stylus, £3/6/-.
GP71 with diamond stylus, £7/13/6.



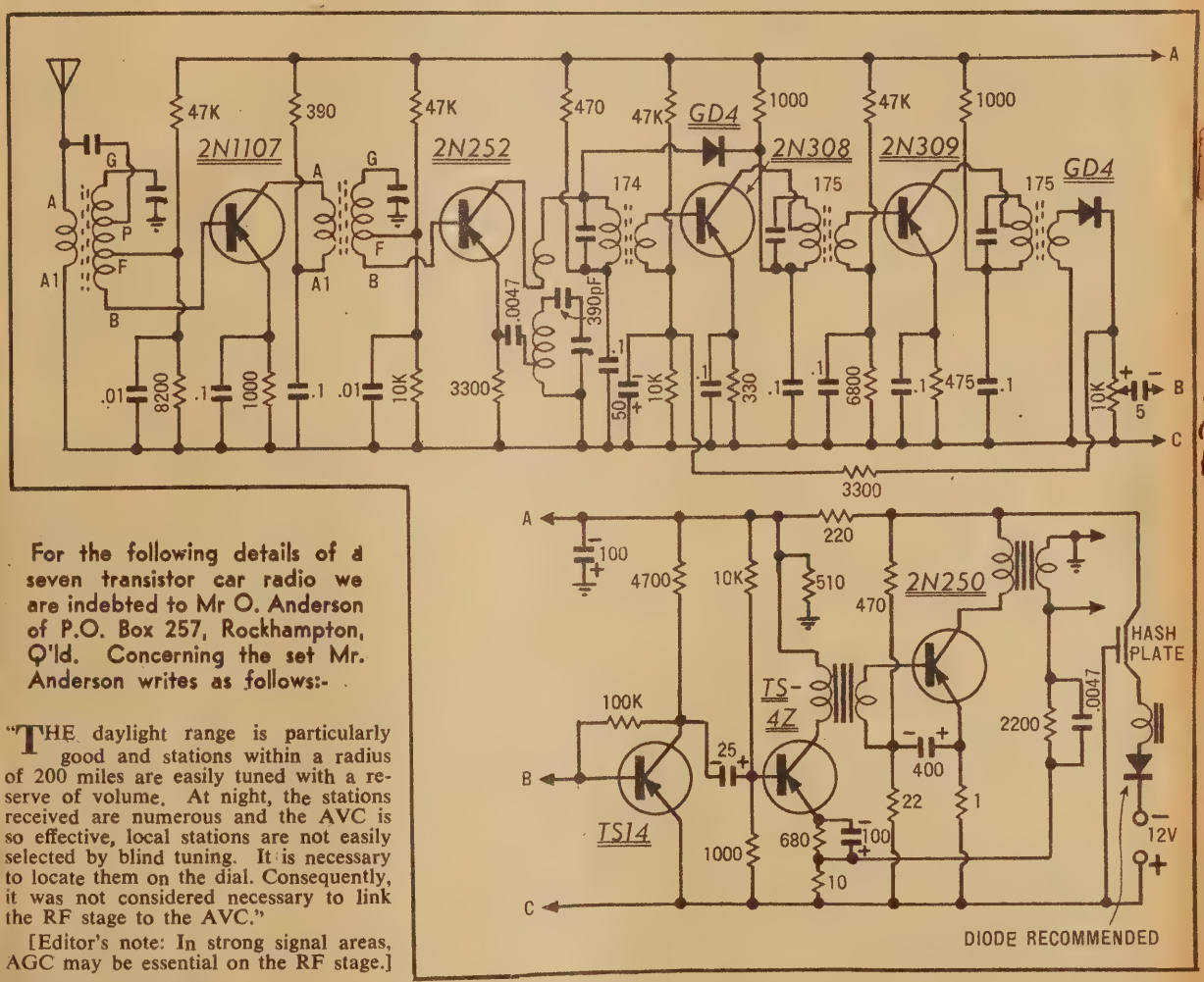
AUSTRALIAN AGENTS:

AMPLION (A/SIA) PTY. LTD. 101 Pyrmont Bridge Road, Camperdown, SYDNEY, N.S.W.

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A TWO-UNIT CAR RADIO USING TRANSISTORS



For the following details of a seven transistor car radio we are indebted to Mr O. Anderson of P.O. Box 257, Rockhampton, Q'ld. Concerning the set Mr. Anderson writes as follows:-

"THE daylight range is particularly good and stations within a radius of 200 miles are easily tuned with a reserve of volume. At night, the stations received are numerous and the AVC is so effective, local stations are not easily selected by blind tuning. It is necessary to locate them on the dial. Consequently, it was not considered necessary to link the RF stage to the AVC."

[Editor's note: In strong signal areas, AGC may be essential on the RF stage.]

COILS MODIFIED

"When first built, commercial coils were not available for the aerial and RF stages and valve prototypes were modified. However, a coil has been made to suit this circuit and a sample received from R.C.S. Radio Pty. Ltd., has been substituted and found very suitable. It is designed as an aerial coil but will serve equally well as an RF coil since, unlike a valve set, the primary winding of the RF stage is necessarily of low impedance.

"The connections of this coil are shown on the circuit. The pins are G, B, F and P and the pin between G and B is marked A in the circuit and the pin between F and P is marked A1.

"With careful attention to layout, there should be no trouble from instability. A 10,000 ohm resistor from the base of the 2N308 transistor to earth cured instability that occurred when this resistor was omitted. This lowered the forward bias and eliminated the tendency of the 2N308 to oscillate.

"A miniature three-gang capacitor (415 pf) was used with an MSL48 type dial. It was required that this set also serve as a portable but the power consumption of the 2N250 was too high for economical use with small batteries.

"To overcome this, the tuner and first stage audio was built separately in a small metal case. The TS34 and 2N250 with transformers and other components was built on to a heat sink of duralium of dimension 6½in x 7in x 1/8in and mounted at the rear of the speaker which, in turn, was mounted in a case just large enough to contain it.

"In use, the speaker-amplifier assembly is mounted under the tray of a Zephyr car and the tuner mounted on top. A four-point plug carries two braided leads for the signal and battery minus connections, the braids serving as the common earth. This connects the two units.

"The aerial has a separate conventional connection. A separate speaker and resistance-coupled amplifier employ-

(Continued on Page 83)

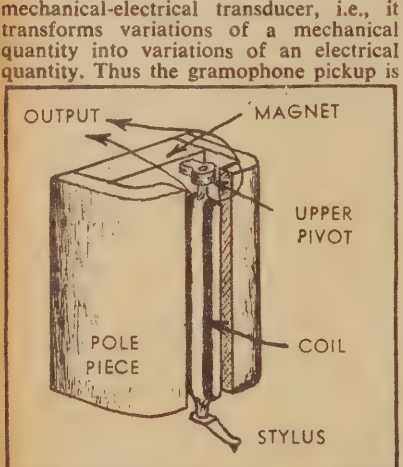
Here's your answer, Tom!

Instead of the usual number of small questions and answers, this month we are answering one question only: "What are the various types of pickups for playing records, and how do they work?"

By Jamieson Rowe

TO answer this question fully, we must deal with stereo pickups as well as monophonic types. However, there are so many types of monophonic pickups that a complete article is needed to cover them alone; thus we are leaving the stereo types until next month.

Basically, a gramophone pickup is a mechanical-electrical transducer, i.e., it transforms variations of a mechanical quantity into variations of an electrical quantity. Thus the gramophone pickup is



Moving-coil pickup.

used to produce electrical current oscillations from the mechanical oscillations of the stylus following the recorded groove.

One way of varying an electrical current is by varying the impedance through which it is flowing; the other way is to vary the EMF or Electro-Motive Force which is causing the flow of current. Both these methods are used in pick-ups, so we can use the two methods as general classifications for all the different types.

VARYING EMF

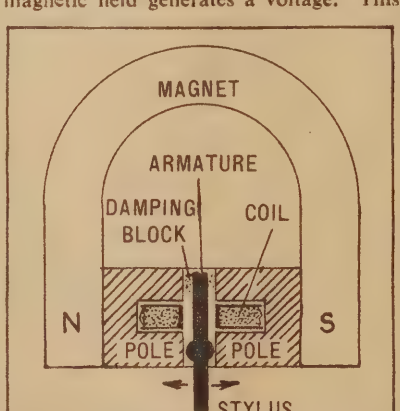
The most common method of transduction is the EMF variation method. In this method, the oscillations of the stylus are used to generate an EMF (or voltage) which also oscillates in amplitude. The method used to generate the EMF may be one of many which are possible.

There are two general methods used. One is the electromagnetic, in which the vibrating stylus causes a change in relationship between a magnetic field and a coil, so inducing a voltage in the coil. The other is the piezo-electric, in which the vibrating stylus distorts a material, which generates a voltage across its faces as a result.

We will deal with these two methods in turn, and then with a type of pickup which generates an EMF by a different method again. Finally, we will discuss the type of pickup which uses the impedance variation method of transduction.

The electro-magnetic method is used by pickup designers in a number of different variations. These include the Moving Coil or Dynamic, the Moving Iron, the Moving Magnet and the Variable Reluctance. These types of pickup have one thing in common: they generate a voltage in a coil by varying the magnetic flux passing through it.

MOVING COIL PICKUPS use the principle that a coil rotated in a uniform magnetic field generates a voltage. This



Moving-iron pickup.

voltage has an amplitude which is proportional to the RATE OF CHANGE of enclosed magnetic flux. The moving coil pickup thus looks something like a moving coil meter movement, except that it has a uniform rather than a radial field.

The coil, which is attached to the stylus, does not fully rotate, but is swung in arcs by the stylus vibrations. Since the generated voltage is proportional to the rate of change of flux, and the rate of cutting of flux depends on the instantaneous stylus velocity, the pickup is known as a VELOCITY-SENSITIVE device.

Since the rate of change of flux in a uniform field will also depend on the angle of the coil, you may ask "why don't they use a radial field, as in a meter, and make the voltage EXACTLY proportional to the velocity?" The answer here is that the stylus actually swings the coil through a very small angle when playing a record, and the slight distortion caused by the angle effect is virtually unmeasurable.

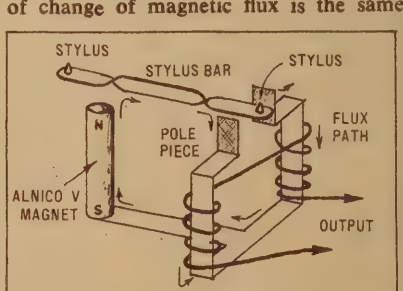
The property of being velocity sensitive is not possessed solely by the moving coil pickup, incidentally, but is possessed by all the electro-magnetic types. This is obvious when one realises that these types all rely on a rate of change of flux to provide the output voltage.

DISTORTS FIELD

MOVING IRON PICKUPS use the principle that a moving piece of iron in a magnetic field distorts the field, and that a coil of wire placed in such a periodically distorted field will generate an EMF. As you can see from the diagram, the stylus is attached to an armature which is positioned between the poles of a permanent magnet.

A coil is positioned such that it has the armature along its axis, and thus the coil is let into gaps in the magnetic poles. When the armature is vibrated by the stylus, the magnetic flux passing through the armature and hence through the coil changes in magnitude and direction.

If the pickup is well designed, the rate of change of magnetic flux is the same



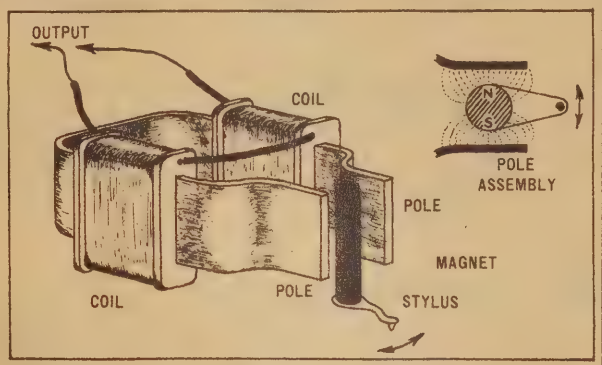
Variable-reluctance principle.

as the rate of change of position of the armature, i.e., the stylus velocity. The moving iron pickup is thus essentially a velocity sensitive device, but can be altered so that the rate of change of flux also depends to a certain extent on the position of the armature.

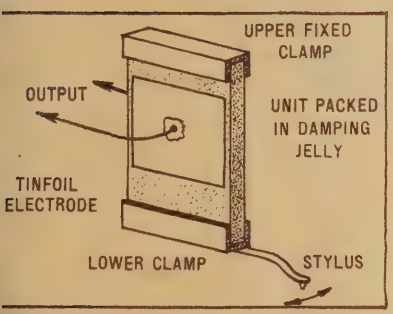
For the reason that this "position sensitivity" cannot always be controlled, the moving iron type of pickup is not

niversally favoured. The principle is ill employed in some of the better qual- / types, however, and, with careful :sign and manufacture, can produce :ry good results.

A type of pickup which is often con- ised with moving iron types is the ARIABLE RELUCTANCE PICKUP. his uses the principle that changes in le reluctance of the magnetic circuit



\ moving magnet type of pickup.



The piezo-electric principle, as used in "crystal" or "ceramic" types of pickup.

irrounding a coil of wire vary the flux assing through the coil, so that a vol- ige appears across the coil. A typical rrangement for one of these pickups shown in the diagram.

When the stylus is moved so that it nearer the front coil than the rear oil, the reluctance of the "magnet-near oil" circuit is reduced, and hence the ux through the coil is increased. In this osition the reluctance of the "far coil- iagnet" circuit is increased, and less flux ows through the far coil.

Thus the vibrations of the stylus are ansformed to flux variations in the oils, and an electrical output is pro- uced. The variations in reluctance can e imagined in this way: an iron or iagnetic material is easy to magnetise nd thus is said to possess a low reluc- tance; a non-magnetic material such as air is much harder to magnetise and is said to possess a high reluctance.

If a magnetic circuit is composed mainly of iron, it thus has a low reluctance and a large flux flows for a given Magnetomotive Force (MMF) such as a permanent magnet. If it contains an air gap in series with the magnetic path, the reluctance of the circuit will be much higher and so the flux will be much less.

The variable reluctance pickup thus creates flux variations by varying the size of the air gaps in the magnetic circuits of its two coils. The two coils are connected in series in such a way that the voltage from one coil when its flux is decreasing adds to the voltage produced by the other coil when its flux is increasing.

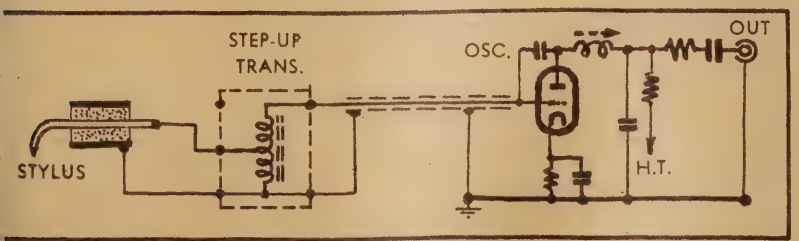
A point to notice in connection with the variable reluctance pickup is that the flux through each coil does not reverse its direction; it only varies in magnitude. In the particular moving iron pickup shown, the flux in the coil actually reverses direction.

MAGNET MOVES

The final type of pickup using the electromagnetic principle is the MOVING MAGNET PICKUP. This type of pickup relies on the fact that flux variations are produced in a magnetic circuit if the source of MMF is rotated in the air gap of the circuit. In effect, it amounts to varying the "source reluctance" of the flux generator as far as the magnetic circuit is concerned.

As you can see from the diagram, the coils are wound on a soft iron "horseshoe" which has extremities formed into poles. The magnet, which is in the form of a thin cylinder of "Alnico V", is mounted in the air gap between the poles.

This magnet is not magnetised in the way one would expect; i.e., north at one end and south at the other. It is magnetised in such a way that the north pole



Illustrating the variable capacitance system.

It's here again

Stock-taking month

HUNDREDS OF 'SUPA' SPECIALS FOR KEEN SHOPPERS

•

TV PARTS

•

RADIO PARTS

•

TOYS

•

Call in now and inspect these bargains which are too numerous to list

At

PRICE'S RADIO

5 & 6 ANGEL PLACE, SYDNEY.

PHONE BL3146

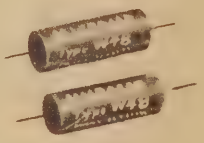
Yes sir! THERE'S A RANGE OF

QUALITY-TESTED **AEE** CAPACITORS

TO SUIT YOUR EVERY REQUIREMENT

TYPE W 99 MICROCAP

★ Patented construction of patterned metallized paper allows extremely small size for miniature applications.
★ Leads actually soldered to unit ensuring positive contact of great strength.
★ Suitable for wide range of frequencies up to and exceeding 100 megacycles per second.
★ Available for A.C. and D.C. working.



TYPE W 48 MICROCAP

★ Metallized paper construction with compact size for applications where space is limited.
★ Wide range of values up to 2 mfd.
★ Extremely low inductance not exceeding that of a piece of metal of similar size.
★ Well-known self-healing feature.

TYPE L 51 PAPER & FOIL CAPACITORS

★ Overlapped foil construction resulting in self inductance of extremely low value.
★ Connections bonded to foil by special process ensuring low resistance at high frequencies.
★ Tough moulded casing providing clean engineering finish and wide range of operating temperatures
★ Available in a wide range of preferred values up to 1,500 volts D.C. working.

AEE

QUALITY-TESTED

CAPACITORS

Complete specifications available upon request

Australasian Engineering Equipment

CO. PTY. LTD.

476 LATROBE STREET, MELBOURNE. FY 2638

N.S.W. Agents: Wm. J. McLELLAN & Co. Pty. Ltd., 126 Sussex St., Sydney. BX 1131

Agents in all States

AE21

uns down one side of the cylinder, and ie south pole down the other side. This an be seen in the small diagram of the ole assembly.

The stylus arm is connected to the wer end of the magnet, and thus the scillations of the stylus swing the mag-et through a series of arcs. (You will otice that no bearing or suspension has een shown for the magnet assembly; his is to simplify the diagram for larity.)

As the magnet is swung by the stylus ie effective air gaps in series with the wo poles in the coil circuits are varied nd the resulting flux variation produces voltage output as before.

The second EMF variation method is he piezo-electric system. This is used y pickup designers in two main types— he Crystal and the Ceramic. These two re made in two further subdivisions — he "bender" type, and the "twister" ype.

UNDER STRESS

The CRYSTAL PICKUP operates on he principle that if a crystal of certain naterials is physically stressed, potential lifferences appear between certain faces f the crystal. The crystal pickup, as sually made, consists of a crystal of Rochelle Salts which is mounted so that t is deformed by the sideways move-ent of the stylus.

In the "twister" type of crystal pickup, he excursions of the stylus are made to wist the slab of crystal. When this is lone, a potential difference appears be-ween the two flat faces of the slab. Thus vibrations of the stylus are con-erted to electrical oscillations.

Since the size of the voltage output lepends on the mount of deformation aused, the amplitude of the output vol-age depends on the amplitude of the tylus movement. The crystal pickup is hus known as a AMPLITUDE SENSI-IVE device rather than a velocity sensi-ive device.

The "bender" type of crystal pickup is built so that the excursions of the tylus bend rather than twist the crys-al slab. It is used a little more than the twister type because its design lends it-self better to pickups of the "turn-over" type.

The CERAMIC PICKUP was devel-oped because the normal Rochelle Salts rystal is very sensitive to moisture and temperature and can fail in hot, humid conditions. This is because the chemi-al is quite soluble, absorbs water and has a low melting point.

MORE STABLE

In a ceramic pickup, the distortion-sensitive slab is made of a ceramic mat-erial which seems better than the crys-tal, as it is not moisture or temperature sensitive. Electrically, the ceramic pick-up is similar to the normal crystal, but generally has about half the signal output.

The ceramic cartridge thus would not be a direct replacement for a crystal unit in a simple amplifier or radiogram, as there may not be enough gain available to produce adequate volume. For a higher gain system where a cheap but stable pickup is desired, the ceramic would probably be a better choice than the crystal.

A type of pickup known as the LIGHT BEAM PICKUP uses an EMF genera-tion method which could also be describ-ed as impedance variation and not gen-eration at all!

This pickup uses the photo-electric phenomenon for its operation; a tiny mirror mounted on the stylus arm varies the amount of light from a small lamp which reaches a photo-electric cell. Light photons striking the cathode of the cell cause it to emit photo-electrons, which are attracted to the anode of the cell by a polarising voltage. These electrons constitute a current and, since the amount of light reaching the cell is governed by the stylus, the output current depends on the position of the stylus.

OUTPUT VARIES

As the stylus vibrates, the output from the cell varies and so an output is pro-duced. As the amount of light reaching the cell depends on the position of the stylus, the pickup is thus an amplitude sensitive device. As the cell may be considered as an impedance, the pickup could be described as a simple impedance-variation type. It's a deal more compli-cated than some, though!

A type of impedance variation pickup which is sometimes seen is the CAPACI-TANCE PICKUP. This type of pickup consists of a capacitor of which the sty-lus arm is one electrode and another electrode is placed around or near it.

The capacitance pickup is used in two main ways — the direct impedance method, and the F.M. oscillation method. In the first method, the pickup is placed in series with a high value resistor across a source of D.C. The varying current produced by the capacitance variation with stylus vibration produces an oscil-lating voltage across the series resistor.

This voltage is used as the output and is very small in amplitude. The pickup thus needs rather high amplifica-tion, as there is a limit to the voltage and series resistance which can be used. Naturally, the higher these two quanti-ties, the higher is the voltage output and, unfortunately, the tendency to pick up hum because of the high circuit im-pedances.

GOOD RESULTS

The capacitance pickup, if well desig-ed and applied, can give very good re-sults, however.

In the F.M. oscillation method, th capacitance variation produced by styl vibration is used to modulate the fre-quency of a small oscillator, as the pic up is placed in parallel with the tun circuit. The audio output can be tak from the oscillator in two ways—bo of which have been used.

One uses the fact that the oscillator's plate current varies with the frequenc deviation, due to the tuned anode circui By using the voltage developed across dropping resistor, an audio output can obtained. This is the type of circ shown in the diagram.

The other method uses a discriminato such as are used in F.M. receivers to demodulate the F.M. signal from the oscillator. This also has a high quality output if well adjusted but, as it has quite a few components, can get out of adjustment easily.

This concludes monaural pickups, Tom. Next month we will discuss some designs of stereo pickups and endeavour to explain their operation.

IF YOU WANT

FIRST CLASS PERFORMANCE

YOU MUST USE

IRONCORE

TRANSFORMERS AND CHOKES

FULLY GUARANTEED

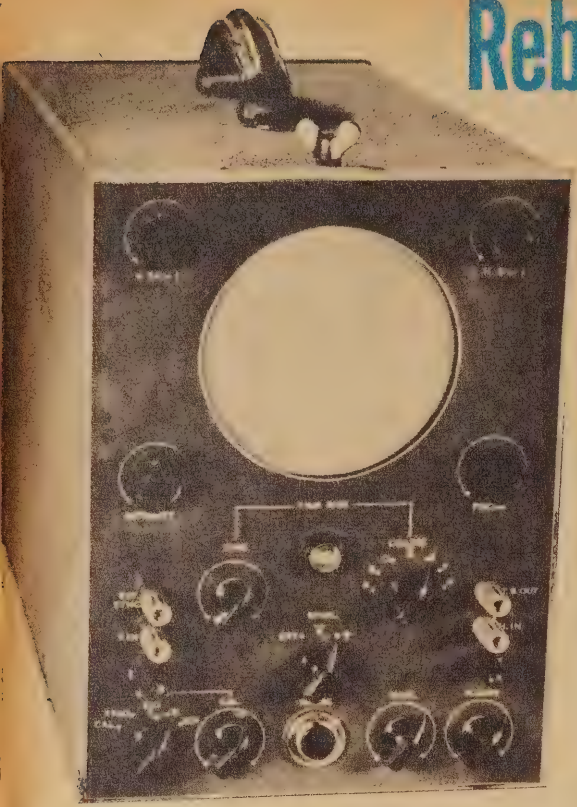
●

IRONCORE TRANSFORMERS PTY. LTD.

HIGSON LANE, MELBOURNE C.1.

PHONE 63-4771

Rebuilding Your C.R.O. To Modern Standards



A front view of the rebuilt oscilloscope showing the revised panel layout. A refinement would be to fit a hood and scribed faceplate over the tube front. The wing nut is used to lock a photographic attachment in place.

This article is specifically designed to assist those who may wish to remodel their old oscilloscope and to bring it into line with present-day requirements. Though the gas triode time base has been retained, and the 6AC7 amplifiers, the performance of the instrument is adequate for all normal laboratory work involving audio and television.

BEFORE proceeding to a description of the instrument, it may be helpful to fill in some of the background to it.

Our first 5in oscilloscope, built around the ex-disposals 5BP1 tube, was described way back in February, 1948. It was a very simple affair, using a gas triode time base and two single-ended deflection amplifiers.

It was enlarged, for the following issue, to include a push-pull deflection system, to secure better waveform presentation for those who did not mind the extra complexity.

SAME APPROACH

Then came our "Standard Oscilloscope" in July, 1952, using the same basic metalwork and the same general circuit approach but with more modern amplifier valves.

These and most other oscilloscopes designed and sold locally about the same period were purely "audio" types in the strict sense of the term. Television and its likely demands were still years away!

However, literally hundreds of these oscilloscopes were built at the time and, when television arrived, along with the techniques of audio square-wave testing, it was natural that the question should arise of extending the high frequency response, particularly of the vertical amplifiers.

Some modest improvements were suggested in the April 1955 issue but, in the following year — August 1956 — new circuitry was evolved which made the instrument eminently suitable for extended audio work and for routine television waveform inspection.

This information is still quite valid but suffers the limitation that it was presented as a modification to earlier designs rather than as a complete self-contained circuit.

Another problem has arisen in regard to the power transformer. This was designed for oscilloscope use in 1948 (or earlier) and, in addition to the necessary heater windings, had a high-tension secondary with one side extended to produce the necessary EHT voltage.

At the time, we understood that the nominal secondary current rating was 30 milliamps, which was more than ample to supply the simple resistance-coupled amplifiers originally used. However, the transformer did not react too kindly to the extra drain imposed by the wider band amplifiers and overheating occurred in some cases. Some re-assessment of the supply position was therefore indicated.

By John Barker

In its revised form, the new oscilloscope is built on the same basic metalwork as the designs mentioned earlier. The same chassis, panel and case can therefore be used over again, with the addition of one cut-out and a few holes. At the same time, of course, there is no reason why completely new metalwork may not be provided and we will issue new drawings if the demand warrants doing so.

While the original holes have been used, however, the layout of components has been varied considerably to secure a more logical wiring sequence. Details of the wiring appear later in the article and should be followed if the performance of the prototype instrument is to be duplicated.

One very important change has been to eliminate the deflector plate connections from the front panel and to make them available, instead, on a separate panel behind a cut-out, towards the rear of the case. While they are less accessible in this position, the number of times that direct access is necessary to the plates is not very great.

What is much more important, the new position of the terminals allows shorter connections between the amplifiers and deflector plates, reduces stray capacitance and therefore contributes to frequency response.

PROBE SOCKET

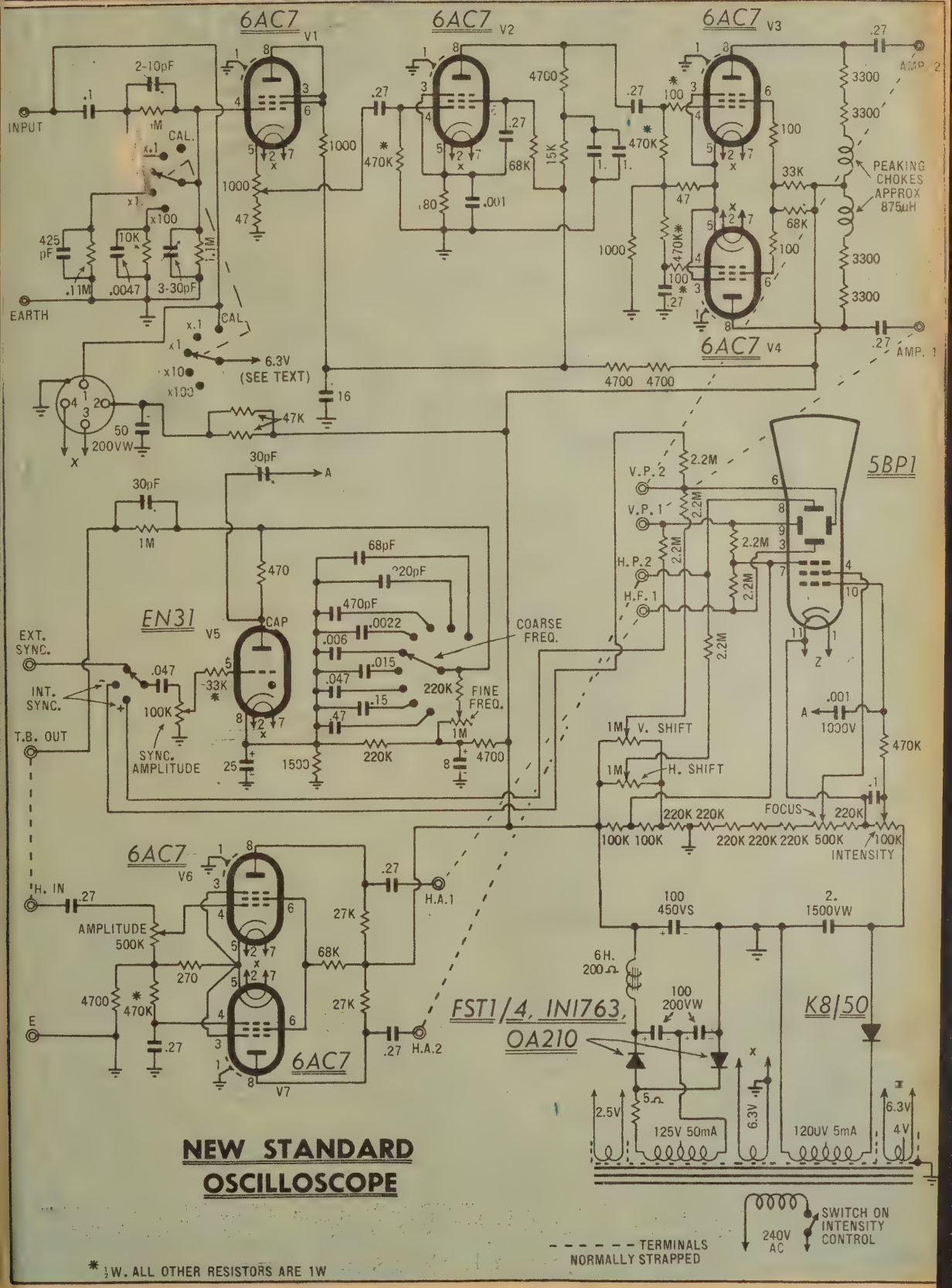
A further point is that more space becomes available on the panel for the vertical gain controls and for a probe input socket, should such a facility be required.

Although, at first glance, the panel changes look quite extensive, they have been arranged to minimise the number of new holes required. It is almost certain that an enamelled panel will be made available for the new instrument, in which case, the panel can simply be slipped over the existing metalwork and hide all evidence of the changes which have been made.

Careful consideration was given to the power supply, mainly as to ways and means of obtaining the necessary additional milliamps for the deflection amplifiers. While a supplementary transformer could have been added, its bulk would have been a nuisance, as well as the hazard presented by an additional magnetic field.

While the possibility of using a supplementary transformer cannot be ruled out, we have arranged for a completely new design, which will provide the necessary voltage and current, without being any larger physically than the original transformer. This has been made possible largely by the use of silicon recti-

DESIGN GIVES HIGH PERFORMANCE AT LOW COST



NEW STANDARD OSCILLOSCOPE

For those who may not have been able to afford our "Wide-Band Oscilloscope" this present design should prove an excellent substitute. The 6AC7 valves are available very cheaply ex-disposals.

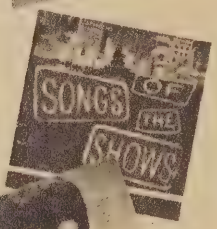
Announcing **MUSIC ON TAPE**

with the brilliant NEW..

SAGA

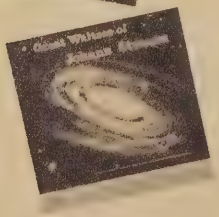
PRE-RECORDED TAPES

7½ i.p.s. & 3¾ i.p.s.



Now . . . with the arrival of the brilliant new SAGA high-fidelity, pre-recorded tapes, you can play the finest classical or popular music on your own tape recorder. SAGA tapes will play on any make or model tape recorder . . . and the vast range, featuring the world's leading orchestras and artists, will cater for the most demanding musical taste. Limited stocks only . . . so hurry!

SAGA tapes are available in 7½ i.p.s. and 3¾ i.p.s. and will last a lifetime. Stereophonic tapes are also available. Write today for the SAGA Catalogue, which lists the range currently available.



Sole Australian Distributors:

BROWN & WATSON ELECTRONICS Pty. Ltd.

281 Latrobe Street, Melbourne. MU 8186

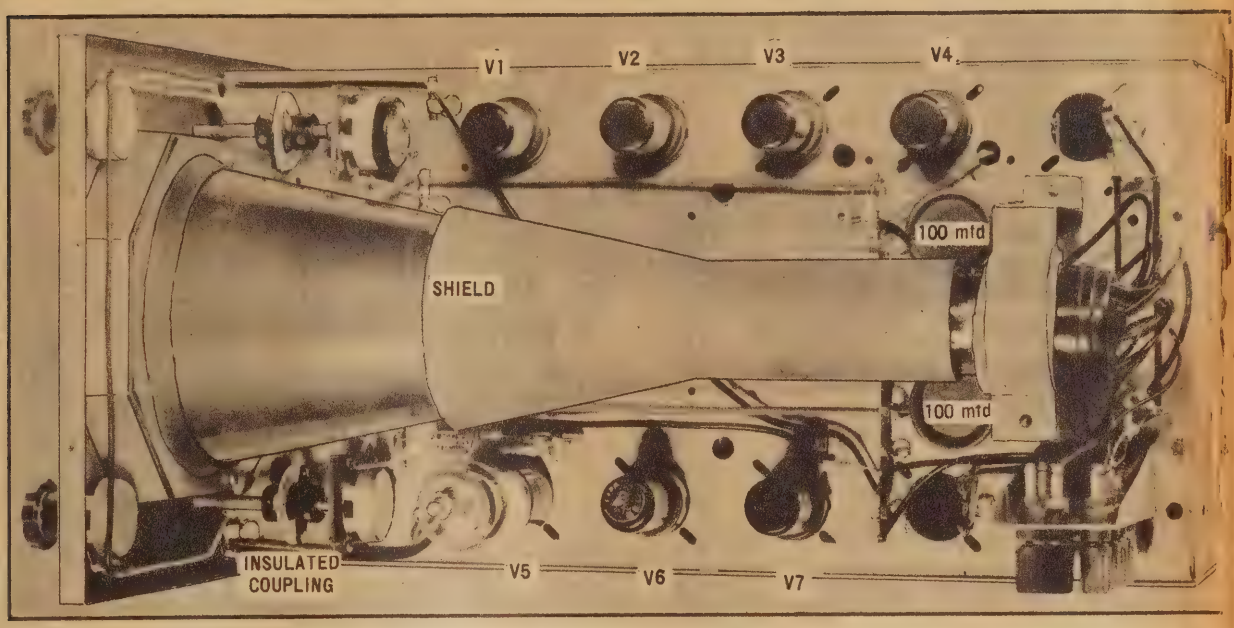
State representatives:

L. G. WALKER & Co.
243 Elizabeth Street, Sydney. BM 6149

TRUSCOTT ELECTRONICS Ltd.
61 Hindmarsh Square, Adelaide. W 2197

T.I.S.C.O.
993 Hay Street, Perth. 21-2940

A TOP VIEW OF THE NEW OSCILLOSCOPE CHASSIS



This top view shows most of the above-chassis components. Note the insulated couplers to the Intensity and Focus controls, also the panel at lower right supporting the deflector plate terminals. For under-chassis views, see following pages.

fiers in place of the older and rather wasteful thermionic type.

The new transformer provides all the necessary heater voltages, a secondary for the normal HT supply, an EHT winding and a filament winding for an EHT rectifier. Individual constructors may therefore use an existing EHT valve rectifier, though we have suggested a selenium rectifier instead.

In the aggregate, the instrument makes up into a very neat and efficient piece of laboratory gear.

WIDE-BAND C.R.O.?

Quite naturally, the question follows as to its relationship to our "Wide Band C.R.O." described in the February-to-May issues, for 1957. Is this now superseded?

The answer is a definite "no." The Wide Band C.R.O. is, in every way, a more elaborate instrument—and a more costly one! If this is no barrier, then by all means build it in preference to the present design.

But if you have an earlier instrument which can be remodelled, or you want something good at a budget price, then the present instrument is the one for you.

So on with the description.

Looking now at the circuit, the power supply system has already been mentioned. Two 6.3 volt heater windings are provided. One, rated at 4 amps, is intended to supply the amplifier valves and operate with one side grounded.

The other, rated at 0.6 amp, is tapped at 4 volts. This is to supply the cathode-ray tube and normally operates at the full EHT potential below chassis. The 4-volt tapping is provided, by the way, to allow the use of tubes other than the 5BP1 and which may have a 4-volt heater.

The normal HT supply is derived from a 130-volt winding, through two silicon rectifiers used in a conventional full-wave voltage-doubling circuit. This calls for the usual voltage-doubling capacitors, one of which has to be insulated from earth. It is normally supplied in a cardboard sleeving, both for insulation and as a safety measure.

A small filter choke and a further 100mfd electrolytic provide the necessary additional filtering. The choke, by the way, should have no more resistance than strictly necessary to avoid undue loss of voltage to the deflection amplifiers.

The EHT is derived from a nominal 1,200-volt winding. A 2X2 or AV11 rectifier may be used, if desired, for which purpose the transformer carries an additional 2.5-volt filament winding. However, we have suggested in our circuit a selenium rectifier of a type currently handled by the STC organisation. Several types would appear to be suitable, including the K8/50, rated to operate at 1,200 volts input, the K8/60 and the K8/70, the last two having somewhat higher ratings.

EHT FILTER

A single high-voltage block capacitor provides the necessary filtering at the small current drain involved. This will need to have a rating of 1,500 volts or higher and, if obtained from disposals sources, should be checked for leakage before use.

The EHT circuitry is arranged to produce an output negative with respect to chassis, the cathode and grid circuits of the cathode-ray tube returning to this negative point. Main reason for this is to allow the deflector plates to operate at near earth potential, for convenience, for safety and to avoid the necessity for high-voltage coupling capacitors to the deflection amplifiers.

A series of resistors and potentiometers, forming a high-resistance voltage divider, connects between the EHT supply point and chassis and provides the necessary gradient for grid, cathode and focus electrode of the 5BP1. In the event of a more complex cathode-ray tube being used in place of the 5BP1 additional voltages could equally well be tapped off this divider.

The high-voltage anode of the tube along with the deflector plates, returns to a similar voltage divider wired across the positive HT supply. Two potentiometers, forming part of this network provide the necessary spot centring facilities.

TOTAL SUPPLY

The cathode-ray tube operates from a total supply voltage of 1,400 volts negative, plus about 350 volts positive, less the drop across the bias potentiometer and the shift controls.

While the tube will stand a much higher voltage than this, and focus the better for it, extra voltage would decrease the reflection sensitivity and complicate the design of the deflection amplifiers. As it is, the figure suggested has proved, in the past, to be an effective compromise.

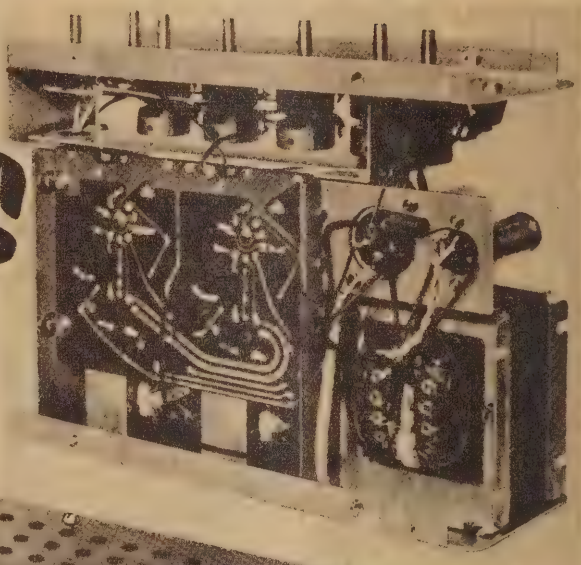
For the time-base sweep generator we have retained the familiar gas triode or thyratron circuit. Whilst its limitations preclude its use in more advanced oscilloscopes, it is quite adequate for the instrument in question.

We have used an EN31 type gas triode in preference to the 884 used in some previous instruments. The manufacturers give the upper frequency limit of this valve as 150 kc, which is considerably higher than that for the 884. One may as well take advantage of the difference, though sweep frequencies of this order are rarely necessary.

If it is desired to use an 884, because one is already on hand, then the

Mullard STEREO 44

Stereophonic amplifier kit



NOW AVAILABLE AT . . .

MAGRATHS

FULLY ILLUSTRATED ASSEMBLING INSTRUCTIONS!

4 WATTS PER CHANNEL!

FULLY INTEGRATED CONTROLS Stereo or Mono

OUTPUTS for full range of speakers

INPUTS for pick-up, radio and tape recorder

COMPLETE KIT, even spanner, wire and solder!

ROY! IT'S UNBEATABLE VALUE AT . . .

£25

YES! THE PRICE INCLUDES SALES TAX

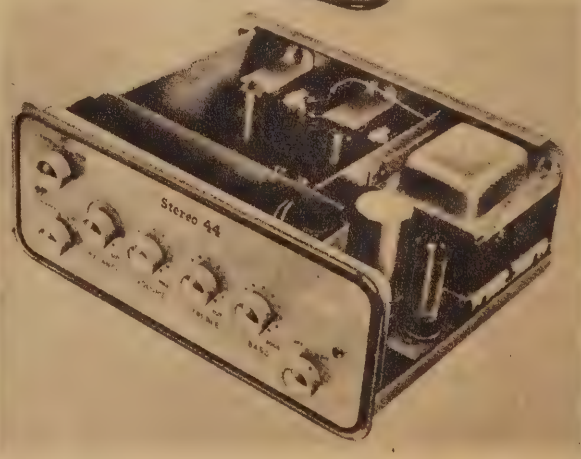
Set of 5 valves only £4/5/.
A bargain-priced extra.

LAY-BY FOR ONLY £5 deposit.

PERFORMANCE DETAILS:—

Total harmonic distortion: 2.5% at 4 watts (1.5% at 3 watts); Sensitivity: 130mV for 4 watts stereo, 110mV for 8 watts, monaural; Frequency response: Flat plus/minus 1 db from 20 c/s—20 Kc/s; Maximum bass boost: plus 16 db at 50 c/s; Maximum treble cut: minus 20 db at 10 Kc/s; Separation: greater than 40 db at 1 Kc/s; Balance any desired combination from 0 to 100% signal in either channel. For 200-250 volt power supply. 5 valves. Dimensions: 11½ x 4¾ x 9in. **ONLY £25; 5 valves extra, £4/5/-.** Add further £5 if required tested, wired and ready for use.

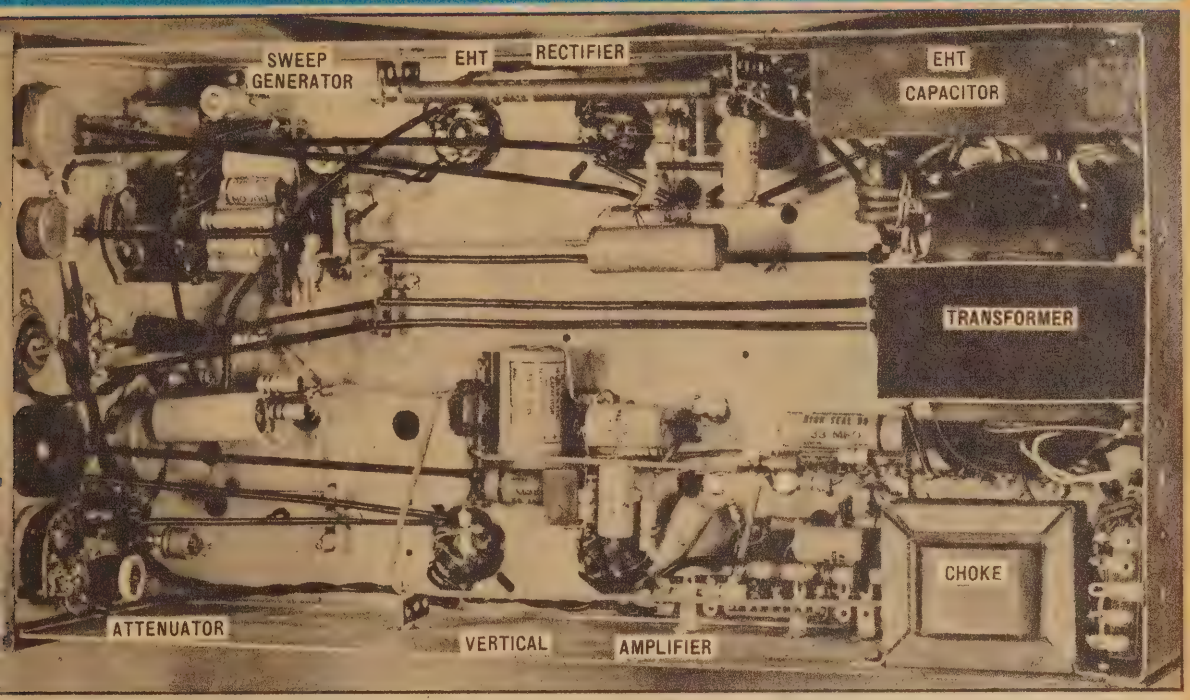
Mail Orders welcomed. Please add freight.



J. H. MAGRATH & CO. PTY. LTD.

208 LITTLE LONSDALE ST. MELB.
C1, VICTORIA 'PHONE FB3731

AN UNDERNEATH VIEW OF THE C.R.O. CHASSIS



The EHT rectifier is on the side of the chassis at the top. The sweep capacitors and their switch are to the left at the top and the input attenuator is to the bottom left. Note that tag strips are used in preference to the tag boards in the original instrument.

mplete sweep circuit from one of the evious CRO's may be substituted for at used here.

We have provided nine switch posi-ons giving a total frequency coverage from approximately 8 c/s to about 0 kcs. It is possible that different s triodes will behave somewhat differ-tly at the high frequency end of their nge, but we have found that the sweep nerator in our CRO is quite stable.

There is some falling off of ampli-de at the highest frequencies, but there more than sufficient gain in the hori-ntal amplifier to cope with this.

INE FREQUENCY CONTROL

A fine control of frequency is pro-ded by the 1.0 meg pot. in series with e main charging resistor.

Provision for synchronisation is made om an external source or from either rtical deflection plate. The sync. level controlled by the 0.25 meg pot. in e gas triode grid circuit.

With the circuit as it is, the linearity the sweep is quite good. If, how-er, it is felt that a more advanced pe of sweep circuit is necessary, then e suggest the Hard Valve Time Base scribed in September, 1956.

The horizontal amplifier consists of o 6AC7s in a "long-tailed pair" circuit. his is a simple method of providing sh-pull deflection of the beam with ly two valves.

Main task of the horizontal amplifier to amplify the sawtooth sweep volt-e without introducing significant de-ioration of the basic input waveform. In practice, a response curve extend-g to about 250 kc is adequate and, any case, is all that can be realised thout unduly comprising gain and peak tput.

For the odd occasions when the horizontal amplifier will be needed for other purposes, the response is likely to be adequate. We have provided access to the input by arranging appropriate terminals on the front panel. A link joins the sweep output and horizontal input terminals for normal CRO use.

The vertical amplifier uses four 6AC7s. In the grid circuit of the first valve there is a stepped attenuator and calibrate control. The attenuator has four positions whereby the sensitivity of the amplifier is changed by a factor of 10 at each position.

Since the grid circuit impedance is very high, the attenuator must be compensated for stray capacitance. This is the purpose of the trimmers and small capacitors across the attenuator resistors.

The first valve is a cathode follower, with a further gain control pot. in the cathode. This is a fine control of gain and, as it is in a low impedance part of the circut, it does not need any capacitive compensation.

CALIBRATION

In the fifth, or cal., position of the attenuator switch, 6.3 volts AC from the filament line is switched to the amplifier input. Then this fine gain control may be adjusted so that the displayed wave occupies some definite vertical height, say one inch.

Since the attenuator is automatically in the XI position when the switch is turned to Cal., the amplifier may be moderately well calibrated to measure the amplitude of unknown waveforms.

The second valve is a straightforward voltage amplifier. The plate load is split and a 2.0 uF capacitor is connected from the junction of these resistors to ground. This is a bass boosting circuit and helps to extend the low frequency response by compensating low frequency losses elsewhere.

As the frequency decreases, the reactance of the 2.0 uF capacitor rises and the overall gain increases.

The last two 6AC7s are connected as a long-tailed pair. In this final stage the main high frequency compensation is carried out with the aid of peaking chokes in the plate circuit.

STRAY CAPACITANCE

The upper frequency limit of an amplifier such as the one we are considering is usually determined by the stray circuit capacitances which exist between plate and ground. They are made up of inter-electrode capacities and those which exist between wiring and components and the earthed chassis. They are, between them, equivalent to one single capacitor shunted across the plate-load resistors.

This is shown in the circuit of Figure 1.

To some extent, the effect can be reduced by decreasing the load resistance so that it is not large compared to the reactance of Cs at the higher frequencies. This is only of limited use, since the overall gain suffers.

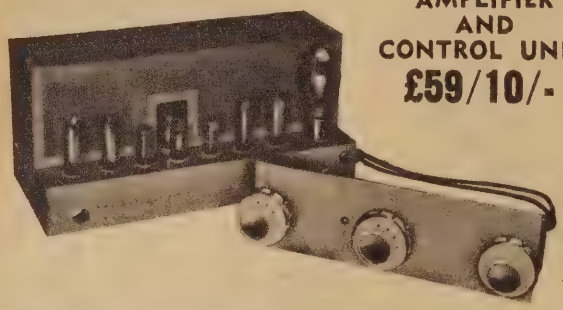
When a small inductor is placed in the plate lead, as is shown dotted, it forms with Cs and R1 a damped resonant circuit. At some frequency, determined by the particular values of Lp and Cs, a resonant peak will occur. We can adjust Lp so that the peak just compensates for the fall-off in response.

If the load resistance, R1, is too small, the resonant circuit will not be sufficiently damped and the resultant peak will cause the amplifier to have poor transient response. Therefore, the cir-

VEALLS SAY — We have obtained yet another supply of . .

VELCO dual '10' AMPLIFIER

- Twin Channel Amplifier, with output of 10 watts per channel, into 15 ohms.
- Input impedances 1 megohm each channel.
- Frequency response 20 cps to 20 k.cps within 1db.
- Total harmonic distortion at 10 watts on 400 cps. 0.3%.
- Hum and noise 75 db. below 10 watts
- Sensitivity 40 m.v. for full output.



AMPLIFIER AND CONTROL UNIT
£59/10/-

VELCO SOUND SYSTEMS PTY. LTD.

A DIVISION OF A. J. VEALL ELECTRICS LTD.
520 BRIDGE ROAD, RICHMOND, VIC.

TANNOY

MONITOR DUAL CONCENTRIC
LOUDSPEAKERS

The "Monitor" dual concentric loudspeaker is the logical development of the already well-established model which, during the last 12 years, has set new standards for the high quality reproduction of sound. This loudspeaker unit is the culmination of over 30 years' continuous research by the largest organisation in the U.K. specialising solely in the development and manufacture of sound reproducing equipment.

PHONE: JB2511 *

TRUE *high-fidelity* STEREO...

in Only TWO UNITS . . . for the amazing price of ***ONLY 89 GNS.***

UNIT 1 (At left) Comprises "Windsor-Mullard" 2-Stereo-2 Amplifier, complete with Stereo Player, 1-8" "Rola" 8MX or "Magnavox" 8WR Speaker (whichever desired), all housed in special design "Warwick" Control Cabinet, has provision for fitting Radio Tuner or your own Radio —very simply if you wish. The whole unit, wired and tested, ready for immediate operation. Fully guaranteed.

UNIT 2 (At right) Comprises "Wharfedale" Speaker Enclosure, for floor or wall mounting, fitted with 1-8in "Rola" 8MX or "Magnavox" 8WR Speaker, just as you choose.

HERE IS THE ANSWER TO THE PROBLEM OF CONFINED SPACE!
IT IS CANNOT-BE-BEATEN VALUE! CALL AND SEE FOR YOURSELF!

See also our other more extensive Stereo Systems, with the most complete range of Speaker Enclosures in Australia, in easy-to-assemble kit form or complete.

All brands of Speakers stocked, including Goodmans, Wharfedale, Philips, MSP, etc. Thorens, Dual, Philips, Garrard, and Collaro Players. Sarlon and Tygan Cloth, Dust Bugs, A.R.U.'s, Diamond Stylii, etc.

TRADE-INS ACCEPTED *TERMS AVAILABLE*

ALBERT WRIGHT

Radio and Cabinet Factory—Speaker Enclosure Specialists
ESTABLISHED 24 YEARS
793 NEW CANTERBURY ROAD, HURLSTONE PARK, N.S.W.
LL2696 TRADE SUPPLIED. N.B. We are OPEN Saturdays.

cuit is designed to have an overall flat characteristic, or at most a very slight rise.

The three possible curves are indicated in Figure 2.

This discussion of some of the design points and the background has, of necessity, been rather brief. If more detailed information is required, we recommend that readers refer to the issues of July and August of 1956 and those containing the Wide Range CRO (February to May and September, 1957.)

This new CRO was built on the old basic metal work which has proved most suitable for an instrument utilising the 5in 5BP1. The photographs show fairly well the layout and the general placement of parts. The smaller sizes of modern components make for a much less crowded chassis.

NEW PANEL

A new front panel, similar to the one appearing in the photograph, will be available commercially and the two or three extra holes required may be marked out from this.

In the old versions, the terminals giving access to the deflection plates were mounted on the front panel. This meant that long connecting leads were required to run from the CRO tube socket to the front panel and back to the rear of the chassis again. This meant considerably more stray capacitance and a consequent risk of limiting the high frequency response.

Therefore we have mounted the eight terminals required on a small bracket over the old EHT rectifier socket, and have cut a corresponding hole in the side of the case to allow access to them. A small hinged door was fixed to the outside of the case over the hole.

Of course, if it is felt that the deflection plate terminals will really never be required, then they may be omitted altogether. For any serious user of the CRO, however, they will almost surely be required some day as, for example, for transmitter modulation checks.

Provision for a probe socket has been made in the bottom centre of the panel. This uses a four-pin shielded socket and the probes designed for the Wide Band CRO may be used directly with this instrument. Some of these were described in the September, 1957, issue.

It is probably safest to wire the two amplifiers and the sweep circuit first. All the 6AC7's are mounted with the base locating pin nearest the chassis sides. This means that the filament leads, a twisted pair, can run round the corner of the chassis out of the way.

TAG STRIPS

An assortment of tag strips will be required. Most of the ones we used were eight-pin types. It is far better to have too many tag strips than not enough. In an instrument of this type it is essential to mount components securely.

The large paper capacitors should be kept well above the chassis in order to reduce stray capacitance. In general, straight point-to-point wiring is necessary also. Use something like 16-gauge wire for all the long leads and cover them with spaghetti tubing.

Most of the attenuator components will mount directly on to the switch. The leads from the attenuator to the cathode follower need to be run straight to the valve-pin socket, and well clear of the chassis. This applies to any of the high impedance leads in the circuit.

The frequency determining capacitors in the sweep circuit will all fit on the switch and the trimmer for the flyback suppression mounts on a tag strip at the side.

PRELIMINARY TEST

If a separate source of H.T. and filament voltage is available, the amplifiers and sweep generator may be roughly tested before the main supply is wired in. This is sometimes a helpful procedure though it is not a necessary one.

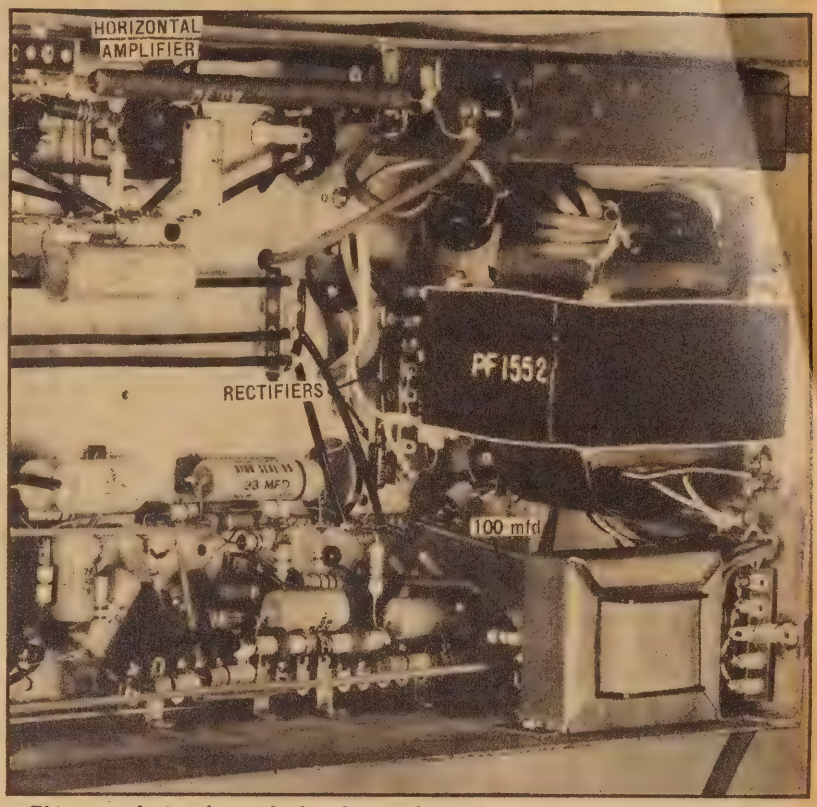
The total H.T. drain of the amplifiers and sweep will be close to 45mA.

For the peaking coils we found that it was sufficient to remove about 15 layers from a Q-plus RF choke, type RFC1. If you follow our layout and design fairly closely you should arrive at a similar result. A more detailed method was given in the August, 1956, issue for those builders who prefer to produce their own design.

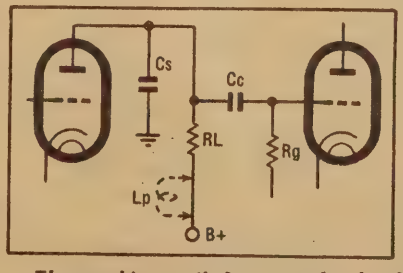
The output leads from the amplifiers to the deflection plates need to be run on tag strips high above the chassis. We passed the two pairs of wires through two valve holes on either side of the CRO tube socket. A three-pin tag strip is mounted above each hole and another below in such a way that the leads pass diagonally through the holes. This can just be seen in the photographs.

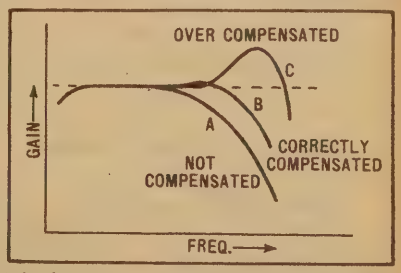
The power supply components are next mounted in place and wired. The selenium rectifier is supported on two tags along the side of the chassis with

ANOTHER UNDERCHASSIS VIEW



This second view beneath the chassis shows the wiring around and beneath the power transformer and filter choke. The unused EHT rectifier winding ends were curled up, rather than being snipped off.





The peaking coil Lp extends the high frequency response beyond that normally attained by a resistance coupled amplifier. The effect of this coil is shown in the curves. Over compensation extends the response even further but the transient response is adversely affected.

Homecrafts PTY LTD

AUSTRALIA'S LARGEST Radio, Television and Hobbies SPECIALISTS

290 LONSDALE STREET, MELBOURNE — FB3711

We have everything for the HI-FI enthusiast

ROLA LOUDSPEAKERS

Model	Price	Model	Price
2C	£1 19 0	3C	£1 17 0
4C	£1 17 0	4F	£2 6 0
5C	£2 0 6	5F	£2 8 0
5FX	£2 10 6	5-4C	£2 2 0
5-4F	£2 10 6	6-H	£2 11 6
6M	£3 6 0	7-5H	£2 13 0
7-5L	£3 2 6	8H	£2 19 0
8K	£2 12 6	8M	£3 14 0
8MX	£4 10 6	9-6H	£3 0 6
9-6L	£3 10 0	10-3G	£2 14 6
12K	£3 6 0	12M	£4 16 6
12MX	£5 18 0	120	£6 0 0
120		12UX	£24 5 0
Deluxe	£6 10 6	120X	£11 4 0
12U	£22 3 6	12PX	£15 5 0

Scope Soldering Irons

Standard Iron £2/16/
Transformer £2/14/

SCOPE PARTS

Elements 1/2
Coppertip 11d
ED Mini Soldering Iron 6V or 12V .. £2/5/0
Trans. to suit £2/9/3
Ersin Multicore solder 12/7
Astor Car Radio
Cowl and Universal Aerials .. £2/19/9

BATTERY CHARGERS

Nilson 6 Volt 4 amp. .. £11 10 0
Nilson 12 Volt 2 amp. .. £11 10 0
Dial Range
6 and 12 Volt £12 6 0
Battery Hydrometers
Ormiston 11 0
Hydrometer floats 2 6

R. & H. INSTRUMENT PANELS

Audio Gen, RC bridge
VTVM, etc .. .. 17 0 plus tax

SOCKET PUNCHES

Pipgras Screw Type

¼in .. .. 28/11 | 7/8in 50/8
5/8in .. .. 28/11 | 1in 54/8
½in 37/4

VAR. CONDENSERS

RCS Min 100 mmfd. 15/0
Strom 2 gang 19/6
AWA 2 gang min 29/3
AWA "3 gang" min 39/0
Ducon Toroidal Core 10/0
Ducon Ferrite pot for
R and H Portable Sets 9/0
Buron Crystal Set Coils
Untapped No. 1 .. .. 9/0
Tapped No. 2 .. .. 9/3

Mail orders promptly handled.
C.O.D. if you wish.

GERMANIUM DIODES

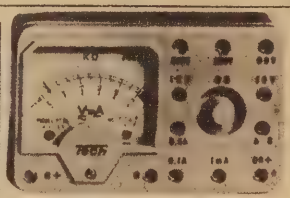
OA70 .. .. .. 5/2 20A79 .. .. .. 12/8
OA79 .. .. .. 6/4 OA81 .. .. .. 5/6
OA90 .. .. .. 8/0

Silicon Power Diodes

OA210 .. .. 19/7 OA211 .. £1/19/3

VAN RUYTEN INVERTERS

32V to 240V 100W £27 19 2
32V to 230V 150W £33 4 3
12V to 230V 100W £29 14 3
12V to 230V 100W £20 7 6



Supplied complete with test leads.

BRAND NEW MULTIMETERS 49/6 Plus postage.

Meter 0-1MA 1000 OHMS PER VOLT

A.C. RANGES	D.C. RANGES	CURRENT RANGES
0 — 10V	0 — 10V	0 — 1MA
0 — 50V	0 — 50V	0 — 100MA
0 — 250V	0 — 250V	0 — 500MA
0 — 500V	0 — 500V	
0 — 1000V	0 — 1000V	

OHMS RANGE—0-100,000 OHMS.

PICKUP CARTRIDGES

Collaro O £2 17 6
Collaro P £2 17 6
Collaro PX £2 17 6
Collaro TX88 .. .. £2 19 9
Collaro Stereo T/O £4 12 6
Garrard GC8 .. .. .. £2 17 0
Acos HGP37 .. .. £2 18 6
Acos GP73 Stereo £5 15 0
Ronette Stereo £4 5 6
Elac Stereo Magnetic .. £16 16 0

MICROPHONE SPECIALS

Oddments to clear.

Lustraphone LFV532
Hi imp. Ribbon .. £15/5/0 plus tax
Lustraphone LFV59
50R Pencil .. .. £12/17/6 plus tax
Philips EL4060
Pencil Dynamic .. .. £38/6/4 plus tax
Brown Moving Coil
Micro Inserts 5052 .. .. £3/10/ plus tax
Philips Dynamic
Microphone .. .. £5/17/0 plus tax
Acos Mic 22
Microphone .. £6/10/ plus tax

R. & H. T.V. CHASSIS

with EHT Box .. .. .. £3/0/0 plus tax
Philips Permeability
Tuners NP1200 .. .. .. £1/15/0
Union 2-transistor Miniature
Portable Radio with headphone
earpiece .. .. £5/0/0 plus tax

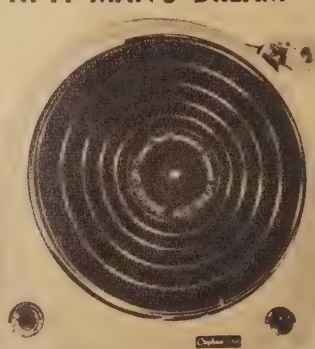
RECORD PLAYERS & CHANGERS

Collaro 4-Speed Player £10 10 0
Collaro Conquest 4 speed changer £13 0 0
Collaro 4T200 Transcription £26 15 0
Collaro 4T200 less Pick-up £20 0 0
Philips Stereo Player AG2009 .. .. £13 13 0
Garrard RC121 Changer £20 17 6
Garrard RC88/4 Changer £24 17 0
Garrard 4HF Player .. £29 16 6

SUPER BARGAINS

TMK Tester 20,000 ohms per volt.
DC and AC to 1000 V.
Resistance to 10 megs.
MA.—50 micro amps to 500mA.
£6/15/ plus 12½% Tax.

THE ANSWER TO THE HI-FI MAN'S DREAM



THE ORPHEUS "SILEX" 4-SPEED TURNTABLE £37/14/8

SPECIAL GD3 DIODES 4/- plus tax

NEW 4 SPEED RECORD CHANGERS, £14 plus tax

These new 4 speed record changers are equipped with high fidelity crystal pick-up and sapphire needles. Can also be used as a manual player.

NEW 3in PER-MAG SPEAKERS

20/. Post and Packing 3/6.

HIGH IMPEDANCE HEADPHONES

NEW 27/6. Post 2/6.

RECORDER MOTORS

New Collaro Recorder Motors
240 volt. A.C. Adaptable for many uses.
37/6. Post extra.

NEON TEST SCREWDRIVERS

8/6 ea.

COMPLETE RANGE

A & R

Audio and Power Transformers always in stock

MAIL ORDERS PROMPTLY HANDLED. C.O.D. if you wish.

Call or Write NOW! **290 LONSDALE ST., MELB. FB3711.** ***Trade Supplied***

one end close to the terminals of the high voltage capacitor.

When mounting components in the high-voltage section on to tag strips, it is a good idea to remove the tag on either side of the tag in use. This leaves a fair area of bakelite to withstand the voltage if for some reason, such as atmospheric humidity, it becomes damp.

The two controls for intensity and focus are connected into the high voltage end of the EHT divider. Therefore there will be a large potential difference between the resistive element and the normally earthed case of these pots.

In order to forestall any voltage breakdown, we have mounted each pot. in a small square of bakelite and supported it on metal brackets. This allows about ¼in of bakelite between the body of the pot. and the earthed chassis.

NO TROUBLE

We feel that with the power transformer in the position shown in the photograph, there should be no trouble with hum introduced by magnetic fields.

However, it may be just as well to temporarily secure the transformer until it is wired, then when the CRO is being tested it can be rotated to select the best position. In all probability this procedure will not be necessary.

When the CRO is wired some adjustments to the various trimmers will be necessary.

The input attenuator is really best adjusted with the aid of a square-wave generator. Ideally another properly adjusted CRO should be used to make sure that the square wave is indeed square, otherwise the attenuator may be incorrectly set.

For example, if the square wave has rounded corners to begin with, the CRO may inadvertently be adjusted to an overshoot condition because one will tend to offset the other. Or just the reverse may happen.

If you are reasonably sure of the square wave, set it at about 1,000 c/s. Turn the attenuator to the X10 position and adjust the small trimmer across the 10-meg resistor for the squarest waveform. Then turn to the X1 position and adjust the 3-30 pF trimmer.

SINE WAVE CHECKING

Turn to the X100 position and, if the wave is distorted, it may be necessary to slightly alter the value of the 0.0047 uF.

If there is no square wave generator available, an ordinary sine wave oscillator will do. It will be necessary to make several frequency runs from about 1,000 c/s upwards in order to see if there are any peaks or humps in the response. The trimmers are adjusted in the same sequence as with the square-wave source.

As a last step, it is wise to check that the attenuator ratios are correct for several different frequencies.

It would be preferable to use high stability resistors for the attenuator in the interest of long-term accuracy. In any event, it will be worth measuring them to make sure of their values.

The trimmer at the plate of the gas triode controls the retrace blanking. The effect of the retrace is most noticeable at higher frequencies, so it is best to adjust the trimmer with a signal somewhat in excess of 20 kc. Set the trimmer in the position which gives minimum retrace, without simultaneously blacking out or reducing in intensity any of the forward trace.

The trimmer across the 1.0 meg resistor between the sweep circuit and the T.B. out terminal is another compensating capacitor. Set the horizontal gain control so that the sweep is about three inches wide and adjust the trimmer for best linearity.

This means that the distances between the tops of adjacent sine waves are the same across the width of the display. If the linearity is not correct, the waveform displayed will be cramped toward one side of the screen.

When all adjustments have been made, fix the trimmers with a dab of nail polish or clear lacquer.

A DEVELOPMENTAL TUNNEL DIODE

We felt that a spot of history had been made when the tunnel diode pictured below arrived in our laboratory with the suggestion that "here is something you might like to play with."

IT was only a few months ago that "Radio, Television and Hobbies" carried what was probably the first major article on the subject for a "popular" magazine, anywhere in the world. The article was prepared, in the first instance, by engineers of the General Electric Co., America.

It was certainly a technical scoop, as far as Australia was concerned.

Now comes an actual diode supplied, in this case, by Messrs Standard Telephones and Cables Pty. Ltd.

Two types are mentioned in the accompanying literature, namely JK10A and JK11A. They are purely pilot samples, being made available for preliminary circuit development only. List price quoted is £3/10/9 but they are sold with no guarantee of continuing supplies and with no undertaking that the frequency response of individual samples is, in any way, indicative of what can be achieved with tunnel diodes.

Tentative application date suggests circuit conditions which apply for use as a tuned amplifier, an oscillator and a bi-stable flip-flop.

The 6AC7's which we use in this instrument are all disposals types. They were sold as new, and it is true that they have never been used. However, in many cases, they may have been originally manufactured during the war years and have had a long and varied "shelf life" ever since.

There would, in any case, have been a normal spread in their dynamic characteristics and this could only have been accentuated in the intervening years.

The point is that they are very inexpensive and it often pays to purchase more than the actual number required.

If, for instance, in this particular case, the deflection in either direction is not what it ought to be, it would be much better to try changing some of the 6AC7's rather than to alter any of the circuit constants, which are correct.

So far as resistor ratings are concerned, it will be just as well to use 1-watt types in all cases except for grid returns and the grid stoppers.

For the capacitor ratings there are two aspects to consider. One is the voltage they must withstand and the other is their physical size.

RESISTORS, CAPACITORS

In the vertical amplifier, especially, large paper capacitors will add to the stray capacitances. Therefore, we have used the smallest capacitors we could buy for a given capacitance.

For the 2.0 uF. in the plate circuit of the second valve, we have used two Philips' type B9, 125 volt, 1.0 uF. capacitors. These, or their equivalents, are recommended.

All the 0.27 uF. are 400-volt types and the capacitors in the sweep circuit should not have less than this rating.

An alternative to the 5BP1 is the VCR97. It is also obtainable through disposals and is an excellent CRO tube. It has a four-volt heater and may be run from the four-volt tap on the new power transformer.

A few finishing touches, of a mechanical nature, will enhance both the appearance and the utility of the instrument, if you feel inclined to add them.

REFERENCE SCALE

One measure is to provide a scribed face-plate to fit in front of the tube face. A suitable pattern is six vertical and horizontal lines, each 0.6 inches apart and forming a 3-inch square. By the use of the calibration facility and the shift controls, patterns can be related to the subdivisions and read off in terms of so many volts, peak to peak.

Do not forget, by the way, that any given reference voltage, read as an RMS value on a meter, must be multiplied by 2.82 to convert it to peak-to-peak, as read on a C.R.O. face.

The scale should ideally be scribed into a piece of green perspex and the lines filled with white. Since the green perspex will attenuate all incident and reflected light except green—which is the colour of the trace—it increases very greatly the contrast and allows the instrument to be used more easily in well-lit surroundings.

EQUIPMENT TROLLEY

"PAYNECO"

C.R.O. & SQUARE WAVE GEN. BY SOLARTRON

SAVES TIME & COSTLY ACCIDENTS

Rubber surfaced table tilts 30°
Adjustable Depth, 14"-23"
Hammertone & Chrome Finish
3½" Insulated Castors
Max Load—2 cwts.
Top 19" W., 26" H., 26" L.
Bottom 19" W., 21" L.

RONALD J. T. PAYNE PTY. LTD.

385 BRIDGE ROAD, RICHMOND, VIC. JB 1416

QLD. H. MARTIN, Wilson House, Charlotte St., Brisbane. B 1785-6.

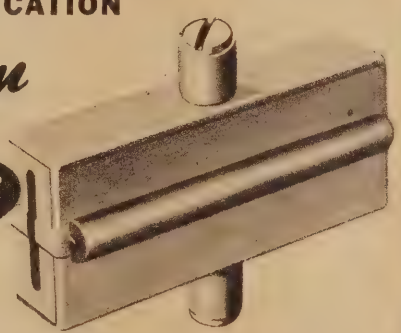
W.A. SALES PTY. LTD., 1142 Hay St., Perth. BA 9781

ELIMINATE EXTRA TV ANTENNAS

AND AMPLIFICATION

with the *Cunningham*

ML-300



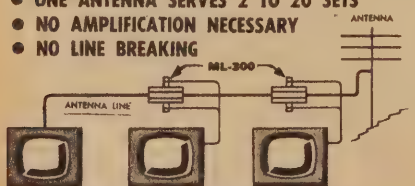
ELECTRO MAGNETIC

TV SET COUPLER

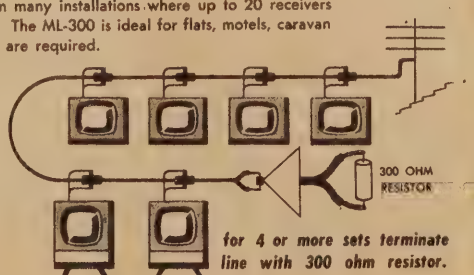
FOR 300 OHM TWIN LEAD

The high electrical efficiency of the ML-300 is proven in many installations where up to 20 receivers are operated from one antenna — without amplification. The ML-300 is ideal for flats, motels, caravan parks or in any installation where multiple T.V. outlets are required.

- ONE ANTENNA SERVES 2 TO 20 SETS
- NO AMPLIFICATION NECESSARY
- NO LINE BREAKING



TYPICAL 2 OR 3 SET INSTALLATION.



for 4 or more sets terminate line with 300 ohm resistor.

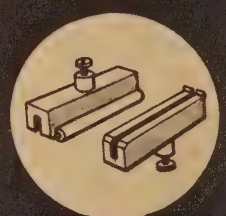
FOR COMPLETE INFORMATION AND SUPPLIES CONTACT R.198

Sole Australian Factory Representatives: Cable: "Cunnig"

R. H. CUNNINGHAM PTY. LTD.

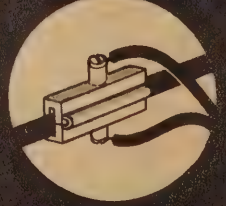
VIC.: 8 BROMHAM PLACE, RICHMOND, 42-1614
N.S.W.: 16 ANGAS ST., MEADOWBANK, 80-0316
Q'LD.: 43 BOWEN STREET, BRISBANE, 2-3755
S.A.: 14 STAMFORD COURT, ADELAIDE, 51-6392
W.A.: 10 MELVILLE PDE., STH. PERTH, 67-3836

EASY TO INSTALL
THE ML 300
SLIDES APART



PLACE TWO HALVES ON LINE AND SLIDE TOGETHER

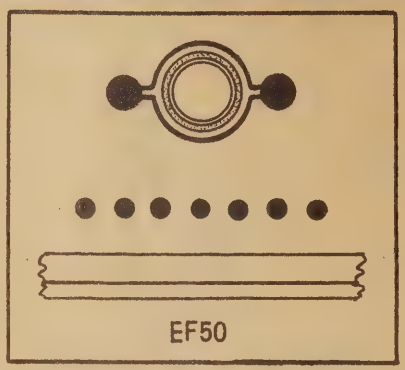
NO CUTTING — SPLICING SOLDERING — NO SHOCK HAZARD

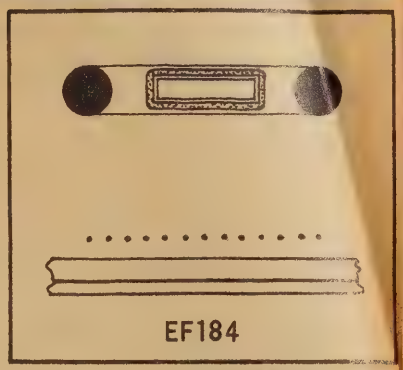


CONNECT TO SET

HIGH GAIN WITH FRAME GRIDS

Frequent reference has been made of late to "frame grid valves." This article explains what is meant by the term and the influence that frame grid valves may have on television receiver design.





These sketches illustrate graphically the difference in control grid structure of an old-style high-gain valve (EF50) and a frame-grid type (EF184). In the one case the grid wires are more or less self-supporting; in the other they are stretched tautly around a stout supporting frame.

IN actual fact, the frame grid idea is not new, as valves incorporating frame grids were in use as early as 1943. Since then they have been used in various transmitting valves, for example in the QQV02-6, which has two separate frame grids, one for each of its tetrode sections.

The present interest in frame grid valves is largely the result of current pressure to simplify domestic television receivers. Already, in the few years that television has been operating in Australia, the number of valves per receiver has fallen from something like 22 to around 15.

SIMPLER CIRCUITS

In part, this has been due to the use of semi-conductor diodes but there has been an overall simplification of circuits. The once "standard" 4-stage video IF strip has given place, in most receivers, to a 3-stage strip but this has been regarded as the minimium, both in respect to gain and ability to obtain the requisite pass band characteristic.

Is a 2-stage video IF strip feasible?

Governing the gain of a particular valve in such a stage is a factor called the FIGURE OF MERIT. This is basically dependent on the ratio of mutual conductance slope to interelectrode capacitances and the higher this ratio can be coaxed the greater the gain obtainable at high frequencies.

The mutual conductance slope of a valve depends, in turn, mainly on the control grid-cathode spacing which thus becomes a measure of the efficiency with which the grid controls the cathode-anode flow of electrons. A grid which is closer to the cathode is generally more efficient than one which is further away, particularly if the turns are closely wound.

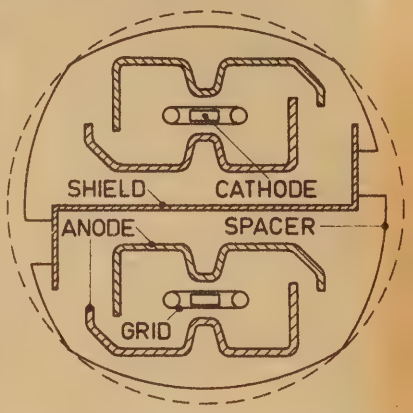
Thus the solution of the stage gain problem would seem to be in reducing the grid-to-cathode spacing. This would increase the slope of the valve and allow adequate gain from fewer — in this case two — amplifier stages.

However, there is a limit to the degree by which grid-cathode spacing can be reduced with conventional construction, since it becomes difficult to maintain adequate rigidity and accurate positioning of the electrodes. This increases the likelihood of interelectrode shorts and microphony as well as producing an undesirable "spread" in the characteristics of the particular type.

HIGHER CAPACITANCE

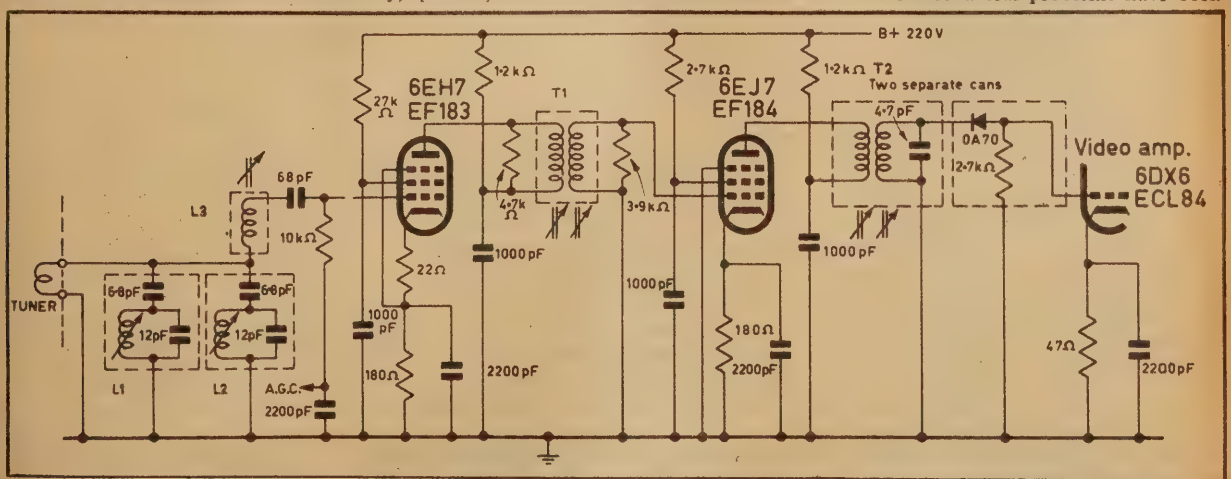
Further difficulty arises from an increase both in interelectrode capacitance and equivalent noise resistance.

The practical limit using conventional construction is about 8 mA/volt which is a transconductance of 8,000 micro-Mho. The EF80/6BX6, for instance, a typical television IF valve, has a slope of 7.4 mA/volt. To go much beyond this appears difficult and rather risky at present, unless the mechanical limitations of conventional construction are overcome.



A plan view of the new 6ES8/ECC 189 frame grid twin triode. While the frame-grid structure ensures very high tranconductance, the specially shaped anode structure presents the necessary surface for the electron stream but minimises capacitance between anode and grid/cathode.

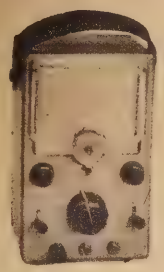
These mechanical problems have been



A developmental two-stage video IF amplifier using a pair of frame grid valves, one variable-mu, one sharp cut-off. Inductor specifications appear in "Mullard Outlook" (Australian Edition) for January-February, 1960.

MASTER ELECTRICS PTY. LTD.

A WHOLLY OWNED SUBSIDIARY OF MOTOR SPARES LTD.



TECH VACUUM TUBE VOLTMETER Model PV58

The PV58 is ideal for service on TV sets, transistor radios and many other electronic tests. It will measure DC voltages, AC voltages, ohms, RF and high voltages, also has Zero Centre Indication. Valves used are 6AL5 and 12AU7.

DC and AC Voltages. 1.5, 5, 15, 50, 150, 500, 1500. **Ohms.** 0-100, 1000, 10,000, 1 meg., 10 meg.
High Voltage with HV20 High Voltage Probe 30, 100, 300, 1,000, 3,000, 10,000, 30,000.
RF Voltage with RF22 high Frequency Probes 0-20 volts R.M.S.
Very solid construction in metal box size: 7 x 4¼ x 3¼ins. Weight 3¼lb.
A real bargain for £19/10/-, plus 12½ per cent tax £2/8/9, total £21/18/9 plus postage.
Extra for R.F. Probe £2/6/6, plus 12½ per cent tax 5/10, total £2/12/4 plus postage.
Extra for H.V. Probe £3/3/-, plus 12½ per cent tax 7/11, total £3/10/11 plus postage.

KEW MULTIMETER

Size 4in x 2in x 1½in. Complete with test prods.
Ranges A.C. and D.C. Volts, 0-15, 150, 1,000.
D.C. Current 0-150 mA.
Resistance, 0-100,000 ohms.
Sensitivity, 1,000 ohms per volt.
An ideal pocket meter for the serviceman, motor mechanic, home constructor.
Reduced from 79/6 to 57/6.

TESTER BOY MULTIMETER

The Tester Boy Multimeter is ideal as a portable instrument for the hobbyist, motor mechanic, etc.
Dimensions are:—6in high, 2½in wide, 3¼in deep. Weight, 1lb 13ozs.
Ranges as follows:—Volts A.C. and D.C. 2.5, 10, 50, 250, 500, 5000.
Resistance: 0-10,000 ohms, 0-100,000 ohms and 0-1 meg ohm.
D.C. Current:—0-1, 10, 500 mA.
Decibels minus 20 db to plus 10 db, to plus 22 db.
By referring to a chart up to plus 56 db may be measured.
The case is black bakelite with a metal panel 3in meter. Test leads are provided and also a leather carrying case. Sensitivity of meter is 1,000 ohms per volt.
Price of this unit is £7/10/-.

TRANSISTOR SET BUILDERS!!

WRITE FOR OUR FREE PRICE LIST ON ALL TRANSISTOR PARTS.

★ SPECIALS ★

1. **Type 108 Chokes, 40mA.** Ideal for small mantel sets, car radios, vibrator sets. **Price only 3/9 ea.**
2. **VCR 138 Cathode Ray Tube, 3½ inch diameter,** Filament volts 4, Filament current 1 amp, Anode 2-200 volts, Grid 1-50 volts, Anode 3-1,200 volts, Electro-static deflection. Colour green. **Price only 25/-.** Socket connections available on request.
3. **815 Push Pull Beam Power Amplifiers** for RF work, good for high frequency. Will give up to 60 watts output. **Price only 35/-.**
4. **Car Radio Aerials.** Side mount Car Aerials. One-piece stainless steel rod, single hole mount type. Ideal for Volkswagen. **Only 15/- each.**
5. **Car Radio Aerials.** Top Cowl type car aerials, one-piece stainless steel rod complete with 3ft lead to suit Astor Air Chief and Ford Radios. **Only 25/- ea.**
6. **Car Radio Aerials,** Side Mount Aerials, 3-piece chrome plated, 2 hole mounting, complete with lead in. **Only 35/- ea.**
7. **Long Playing Recording Tape,** 1,800 ft. on 7-inch spool. Good quality. Brand new and boxed. **Only 45/- ea.**
8. **Miniature I.F. Transformers,** brand new with retaining clips, worth 18/6 ea. **Our price, 7/9 ea.**
9. **Isocore Speaker Transformers** 10,000 to 3 ohms. Well-known brand. **Price only 6/- ea.**
10. **Multi Electrolytic Condensers.** 50 mfd. 200 PV, 30 mfd 200 PV, 100 mfd. 25PV. All in one can. Brand new, worth 15/. **Price only 4/6 ea.**
11. **Midget 2 Gang Vernier Drive Condensers.** Brand new, well-known make, capacity 10-415 P.F. Worth 36/. **Our Price 18/6 ea.**
12. **Dry Metal Rectifiers,** ideal for A.C. Battery portables. Contact cooled type 18 RA 1181 60 mA half wave. **Only 8/6 ea.** Type 16K4. **Only 5/ ea.**
13. **Miniature Phone Plugs,** as used in Japanese Transistor sets. **Only 1/6.**
14. **Miniature Phone Jacks,** closed circuit type, match above. **Only 1/6.**
15. **Single Crystal Earpieces,** ideal for crystal sets, etc. **Only 10/- ea.**
16. **Single Magnetic Earpieces** as used in Japanese Transistor Portables, etc. Low impedance. **Only 12/6 ea.**
17. **Germanium Diodes,** English make, brand new and perfect. Ideal for use in Crystal sets for detectors, rectifiers, etc. **Price only 3/11 ea.**
18. **30-0-30 amps Zero Center Ammeter,** 3½ inch moving coil, brand new and boxed. **Excellent value for 30/-.**
19. **7 pin Miniature Sockets.** Second-hand but in good condition. **6d. each.**
20. **Aluminium Chassis.** Undrilled.

5 x 3 x 2 ..	7/8	13 x 7 x 2½ ..	15/4
6 x 4 x 2 ..	8/7	13 x 10 x 2½ .	18/-
8 x 5 x 2½ ..	10/4	17 x 8 x 3 ..	22/6
10 x 6 x 2½ ..	12/7	17 x 10 x 3 ..	25/6
11 x 8 x 2½ ..	15/4	17 x 12 x 3 ..	27/-

21. **Crystal Microphones,** Frequency response 100 to 8,000 cps. Chromeplated finish with 6ft cable. New and boxed. **Price only 25/-.**

SPECIAL NOTICE

All parcels sent Registered Post unless otherwise stated. Postage or Freight must be included with order.

547 ELIZABETH STREET, MELBOURNE — Phone FY0271

BRANCHES THROUGHOUT VICTORIA AND RIVERINA

largely solved, the designers claim, by incorporating, in receiving valves, the frame grid method of construction. In this method the grid is wound on rods or "backbones" of molybdenum, which are held rigidly apart at a predetermined distance by crosspieces welded to the backbones.

The extremely rigid frame thus formed is held physically to very close tolerances. For example, typical tolerances for the molybdenum backbones are plus or minus 0.005mm.

The actual grid wire in such a valve as the 6EJ7/EF-184 is 10 microns in diameter so that it would need many of them, twisted together, to equal the diameter of a human hair. The wire is wound on the frame in the normal way under a tension of about 15 grams — about half the breaking load of the wire.

The total tension on the backbones in a completed frame grid is about 4lb, but the construction of the frame is such that the accurate shape is held constant, not only during its future life, but during the valve processing at about 900 degrees Centigrade.

TAUT WIRE

Thus the grid consists of two exactly flat parallel meshes of taut wire.

This frame grid is threaded over the cathode structure in the normal way and the cathode-grid spacing can be accurately predetermined by selection of the diameter of the backbones. The flatness and rigidity of the grid frame allows very close spacing to be used and the thinner wires (allowable because of the tension applied to provide support) allow the grid to have maximum electrical effect with least mechanical obstruction.

The accuracy of the frame also reduces the deviations in individual valve characteristics, e.g., the "spread" in characteristics, and reduces the occurrence of failure due to grid-cathode shorts.

The increase of input capacitance produced by the grid-cathode spacing reduction is found in practice to be outweighed by the improvement in slope, so that the ultimate figure of merit is increased.

The slope of typical frame grid valves currently available ranges from 12.5 to 15mA/volt, which is about double that of conventional types. On the other hand, the input capacitance, increased by a factor of about 1.4, partly offsets the advantage. However, the figure of merit obtained is still about 1.5 times the previous values, so that quite an improvement has resulted.

The increased figure of merit of frame grid valves has meant that increased gain and signal-to-noise ratio can be obtained in TV tuners. The latest "Mullard" tuner incorporating the 6ES8/ECC189 valve, for instance, is claimed to have almost twice the gain and improved noise ratio compared with its predecessor.

The use of frame grid valves type 6EH7/EF183 and 6EJ7/EF184 in a developmental video IF design by the same company allowed the reduction to two valves to be undertaken. The circuit for this strip is shown in the diagram. The strip is also claimed to have adequate bandpass, through the use of filters in the input circuit.

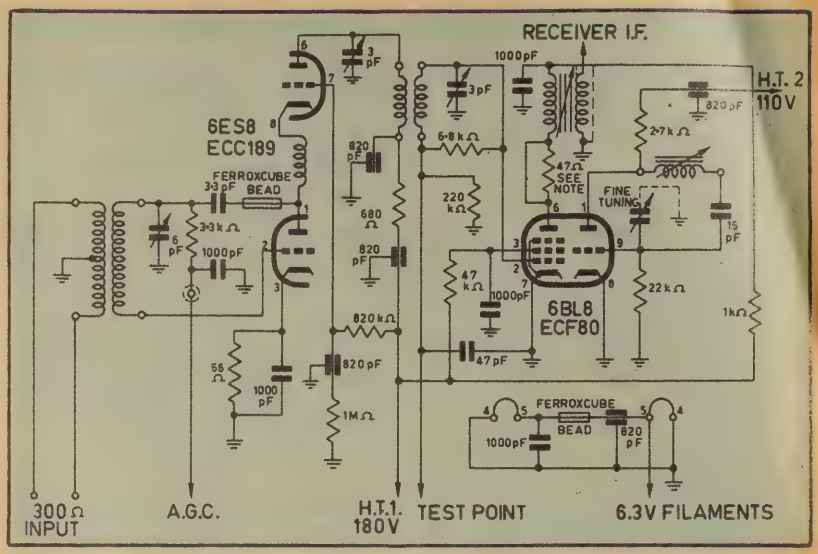
ACTUAL PERFORMANCE

Used with a NT3001 tuner, measured performance of the design having a —3 db bandwith of 4.35 Mc and a —6 db bandwidth of 4.82 Mc is 40 microvolts at the antenna terminals for one volt DC at the diode detector.

The designers therefore claim that a receiver incorporating the new tuner and IF strip has adequate gain for all reasonable-signal areas. Only for fringe-area reception should a further IF stage be necessry.

Incidentally, a type of valve announced recently in America, called the "guided grid" valve, appears to be an adaptation or extension of the frame grid principles. What the modifications will mean in practice have yet to be proved in this country.

HIGH-GAIN FRAME-GRID TUNER



The circuit of the NT 3001 turret tuner, as marketed by the Mullard and Philips organisations. Note the frame-grid cascode RF amplifier, which gives higher gain, lower noise and an improved AGC characteristic.

FLUORESCENT LIGHTS FOR RAIL CARS

(Continued from Page 25)

from the supply is severely chopped. If several inverters are operated from a common supply line, the potential drop in the conductors will impose an AC ripple on the DC supply and, in some circumstances, may give rise to appreciable fluctuations in the light output.

The surge-limiting capacitor reduces the magnitude of the surge voltages across the transistors. Each transistor operates as a switch, and as the circuit is inductive when the switch is opened (as at cutoff), a voltage surge is produced by the magnetic energy stored in the core of the transformer.

Except that the waveform of the output voltage and current is sinusoidal rather than square, the operation of the inverter with a lamp is similar to the process already described.

The transformer is designed with leakage reactance between primary and secondary windings, so that the secondary voltage decreases rapidly as the current increases. In this way, stable operation of the lamp is automatically obtained. (From "Electronics.")

ENCLOSURES
T-V. CABINETS, KITS AND ASSEMBLED.
CABINET KITS
160 HIGH STREET, ST. KILDA, S.2., VICTORIA. Tel.: 94-4819.

MEN & WOMEN
Make up to £50 a week for few hours' light work in your home. Full or part time. All suburbs and country. Write now to Director,
Dept. R.H. 4, Box 5070, G.P.O., SYDNEY.
Please send 5d stamp for reply.

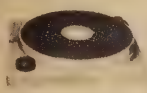
AWA RONETTE
MICROPHONES & ACCESSORIES

Type RFC5
£15/10/8
High impedance) Type RFC5/L.
£21/12/-
(Low impedance 200 ohms). Technical pamphlets will be mailed on request.
Other types also available from
AMALGAMATED WIRELESS
(AUSTRALASIA) LIMITED
Cnr. William and Newcastle Sts., Perth
and leading wholesalers

"NEAT"

HI-FI TURNTABLES, TONE-ARMS, CARTRIDGES, MICROPHONES

P58H
Synchronous Motor
Also P58E Illuminated Stroboscope.



For Professional use and the Connoisseur

TP 134
Record player — 4 Speed Stereo.

"PIONEER"

SM-Q140
Stereo Amplifier with FM-AM Tuner — FM-AM Stereo, AM-AM Stereo, 9 functions.

SM-C800
Stereo Amplifier 45 Watts per channel — minimum distortion.

FM-P300
Amplifier with FM - AM Tuner 15 Watts output.

SM-R151
Stereo Amplifier with FM-AM Tuner. Versatile—de luxe models all Stereo Broadcasts.

AFT-11
Stereo Tuner—Highly Sensitive. Outstanding features —Superb Design.

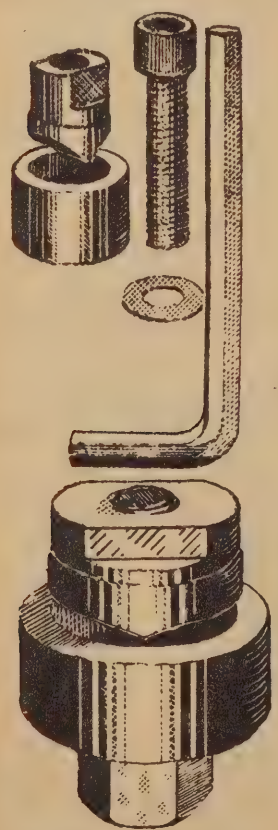
SM-R150
Stereo Amplifier Stereophonic and Monophonic program sources.

FM-R301
Amplifier with FM - AM Tuner. Maximum sensitivity—Beautiful styling.

Trade Supplied

ALEX TAYLOR & ASSOCIATES PTY. LTD.

555 - 563 COLLINS STREET, MELBOURNE. Telephone: 62-3066 62-2169



PHONE: MU3219
TELEGRAPHS: "GENRAD"

"PIPGRAS" HOLE PUNCHES

"PIPGRAS" Hole Punches are made from Alloy Tool Steel, and cut clean and accurate holes in sheet metal. They make a smooth perfect hole without reaming or filing.

SCREW TYPE, ROUND

Supplied with "UNBRAKO" High Tensile Socket Screws and Wrenches
Cut holes in sheet metal up to 18 gauge.

Type No.	Nominal Size	Actual Size	Water Pipe Size (I.D.)	Pilot Drill Size	Price each
32.S	½in	0.507in	—	¼in	**21/8**
40.S	⅝in	0.618in	¼in	5/16in	**21/8**
48.S	¾in	0.742in	⅜in	5/16in	**28/-**
56.S	⅞in	0.884in	½in	⅜in	**38/-**
64.S	1in	1.008in	—	⅜in	**41/-**
72.S	1⅛in	1.133in	¾in	⅜in	**45/4**
76.S	1 3/16in	1.172in	—	⅜in	**45/4**
80.S	1¼in	1.258in	—	⅜in	**49/8**
88.S	1⅜in	1.382in	1in	7/16in	**59/8**

With Heat Treated, High Tensile Steel Hex. Head Bolt and Nut. Cut holes in sheet metal up to 16 gauge.

96.S	1½in	1.512in	—	9/16in	**66/8**
112.S	1¾in	1.762in	1¼in	9/16in	**76/-**
128.S	2in	2.014.S	1½in	9/16in	**83/4**

Sole Selling Agents

GENERAL RADIO AGENCIES PTY. LTD.

528 COLLINS STREET, MELBOURNE, C.1.

Stocked by Radio Parts Suppliers in Every State

VIDEO RECORDING DEVELOPMENTS

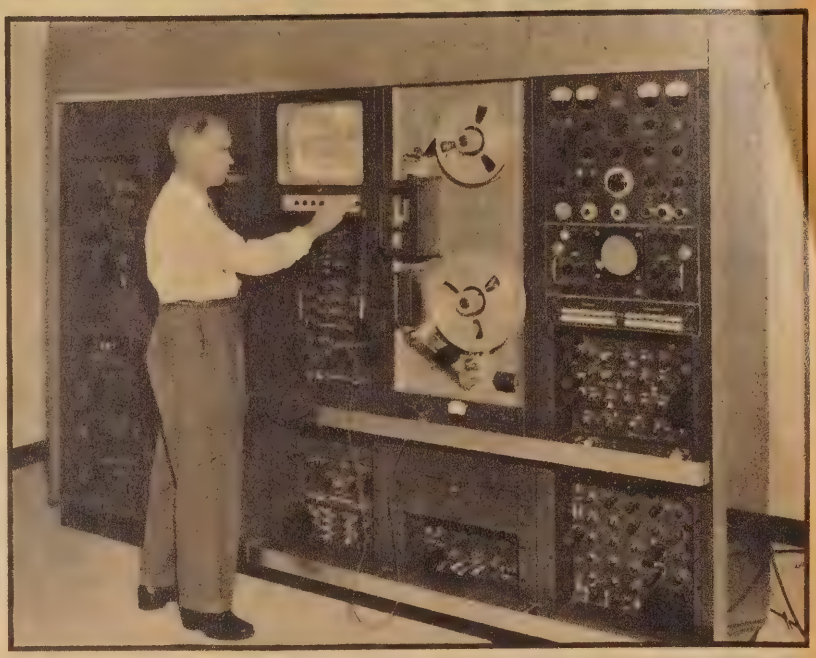
By H. A. Tyrer

A new model video tape recorder, currently being installed by Australian television stations, has important advantages over earlier types.* This article explains the system of electronic quadrature adjustment, which is now incorporated.

ALTHOUGH audio tape recording has been in common use for a good many years, many problems had to be overcome before a workable video tape system became feasible, and much skilful design work has gone into the development of these machines.

The first video tape recorders produced were only partially successful and suffered from certain inherent deficiencies, which were apparent in the picture quality when tapes were played back.

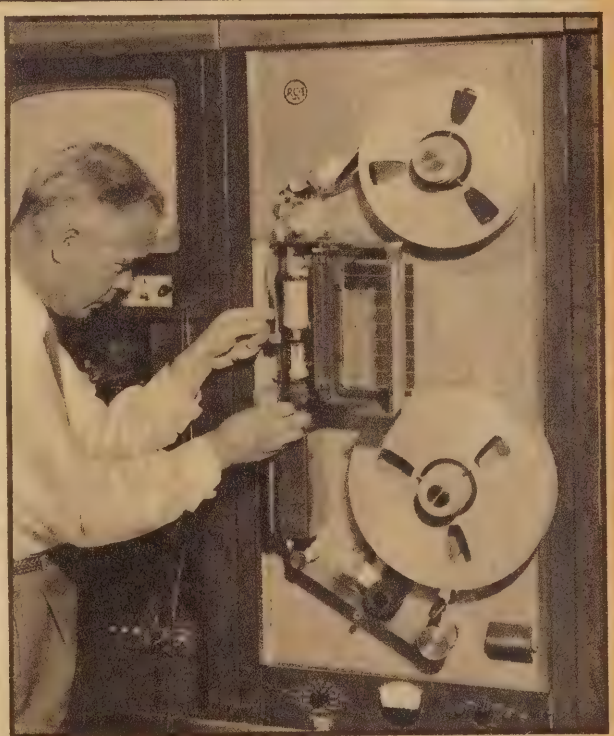
Considerable progress has been made in later machines and the equipment available today is almost completely free from the faults of earlier models.



A modern RCA television tape recorder as supplied by A.W.A. for station ADS7, Adelaide.

☆

A close-up view of the tape carriage mechanism. An erase head is available directly adjacent to the top spool, so that short sections of the recording can be erased and replaced with new material.



☆

NEW RECORDER

Evidence of the advances made in the design of video tape recorders is to be found in the new RCA TRT-1A television tape recorder. Greatly improved performance is claimed for this machine by the manufacturers, due to the unique features it possesses.

These include electronic quadrature adjustment, four-channel playback equalisation, sync. regeneration and the ability to correct tapes recorded on improperly aligned machines in a few seconds, while the tape is actually playing.

Perhaps the most important of these features is electronic quadrature adjustment, with which the line displacement so noticeable in some machines during playback is eliminated.

Line displacement, through errors in quadrature alignment, has previously been one of the major problems of video tape recording. To understand the cause of line displacement, it is necessary to know the principle of operation of the recording head.

FOUR VIDEO HEADS

The headwheel is revolving at right-angles to the tape, which moves by it at constant speed. At 90-degree intervals on the headwheel are four video heads, which thus traverse the tape, laterally, in succession.

During the recording process, the video signals are applied to all four heads in parallel. Each head scans the tape for slightly more than the time taken for the wheel to revolve through a quarter revolution, which in the RCA machine is 1,000 microseconds.

As the tape moves past the headwheel, the video heads produce scanning tracks across the tape, every scanning track containing 17½ horizontal lines of a television picture. Each line is of 64 micro-second duration; therefore the period of 1,000 micro-seconds required for a video head to complete a 90-degree arc corresponds to 15.625 horizontal lines.

There is, therefore, an overlap of approximately two lines between each successive pair of video heads as they scan the tape in turn.

The electronics which operate during the playback mode provide means for switching the output of successive heads sequentially; but since it is not desirable to switch during an active scanning line, this switching occurs during the sync interval at the end of either the fifteenth or sixteenth line in any individual video track.

The number of 15- and 16-line tracks are selected so that they average 15.625 lines. (Audio and cue tracks have been ignored, since they do not affect basic video recording process.)

*** See "Radio, Television and Hobbies" for October, 1958.**

TANDBERG tape recorder extraordinary

People who know about tape recorders will already know about TANDBERG — the tape recorder extraordinary which puts so many of the best features and so much performance into a neat 22lb package. The latest TANDBERG machine, the 3-speed, 4-track Model 5 Stereo, has the same features, appearance and performance as the still current Model 3BF and is also the first 4-track stereo machine on the market.

Winning features of the TANDBERG have always been the compactness, reliability, ease of operation and "studio-machine" performance.

All models have the traditional polished walnut surrounds measuring 15in long, 11 5/8in wide, 6 5/8in high, and each is contained in a pigskin carrying case from which the top can be completely removed.

Wow and flutter are below 0.1 p.c. at 7½in per second. Frequency response for all models is: 70-5,000 c/s at 1 7/8; 40-10,000 c/s at 3¾; 30-16,000 c/s at a speed of 7½.

RANGE AND QUALITY

For dictation, or when a long, uninterrupted playing time is more important than maximum high frequency response, a tape speed of 1 7/8 i.p.s. will give virtually perfect reproduction of speech. Music lacks only the brilliance obtainable at higher speeds, but there is no audible wow or flutter.

At 3¾ i.p.s. music is recorded with quality and presence never before attained at this speed.

At 7½ i.p.s. TANDBERG gives the truest high-frequency full range sound so far attained only with big studio machines at a speed of 15in per second.

Frequency response at all speeds is given as plus or minus 2db. and the signal to noise ratio is 55 db. below highest recording level.

GOOD DESIGN

The mechanical operation is controlled by a single gear-shift type knob at the right. For recording or play-back the knob is pulled forward; for rewind it is pushed to the left; for fast forward to the right. A mechanical interlock prevents accidental erasure.

Starting and stopping is smooth with no spillage of tape, and instantaneous starting can be obtained by pulling the knob forward slightly to start the motor before engaging the idler wheel against the highly polished capstan.

A speed control knob at the top between the reels selects the desired speed and changes tape equalisation at the same time.

Just above this switch is the speaker control which connects the internal speaker to either of the two channels in the case of stereo or disconnects it entirely.

To the left of the lower head cover is the main function control switch with positions for record, playback and public address. In the latter position the microphone is fed directly through the amplifiers and speakers.

The volume control knobs are dual in the stereo machines with a friction clutch causing both to turn at once in normal use, but balancing can be done by displacing one with respect to the other.

Under this dual knob is a lever which selects the mode of operation—stereo or mono tracks 1-4, or mono tracks 2-3. The level indicator eye is just above the volume controls and to the left is a bass-lift switch which increases lows by 12db. at 70 c.p.s. A unique time indicator accurately locates any part of the recording.

All inputs and outputs except the microphone, which plugs into a jack on the top panel, are available at a terminal panel at the rear. A small compartment is provided for the power cord.

STEREO RECORDING

Apart from producing a marvel of compact design, TANDBERG are obviously setting the pace in terms of tape recording technique.

The 3-speed, twin-track Model 3 set the standard of TANDBERG design and performance which remains unchanged and unmatched. It also incorporates an electrically operated foot-control.

The advent of 4-track stereo tapes has tended to supersede the Model 3 with the 3-speed, 4-track Model 4, which also has the foot-control. In this model the second stereo channel is fed into a pre-amplifier of 0.5 Volt high impedance output for feeding into an existing power amplifier.

The new Model 5 Stereo carries the process one step further. A power output stage is included for each stereo channel. The addition of two high quality loudspeakers is all that is necessary for playing back either 2-track or 4-track stereo tapes.

Finally, a Stereo Record Amplifier measuring 8¾in long, 2¼in wide and 5¼in high, is available for Models 4 and 5 to enable high quality stereo recordings to be made.

TANDBERG tape recorders are distributed throughout Australia by **Simon Gray Pty. Ltd.**, of Melbourne, and are available through the leading retailers.

If it were possible to build a perfect headwheel in which each of the four heads were exactly 90 degrees from each other (that is to say, a headwheel manufactured with zero tolerance on the position of the heads), no difficulty would be encountered in time displacement between individual tracks.

However, a deviation in the position of the individual heads will occur in any practical manufacturng process, even when using the highest precision tools available. The displacement of the individual heads by any finite amount from exact quadrature (or the true 90-degree position) appears in the reproduced picture as a horizontal displacement of the "headbands."

This effect is simply due to the video signal from a specific head arriving too early or too late with respect to the preceding head.

When using the same headwheel for playing back a tape as was used for recording, there is virtually no time displacement, since the effect cancels out. This is because the existing error in the position of any video head will be the same during playback as during recording.

However, when tape is used which was recorded with a different headwheel, the relative difference in position of the individual video heads will result in line displacement.

DELAY LINES

To overcome this problem, the RCA recorder employs two sets of four precisely constructed adjustable electrical delay lines, one set for use during recording, the other set during playback (Fig. 1).

To understand the operation of these delay lines, first consider the sketch of a headwheel in Fig. 2. Let us assume that head No. 1 is 30 seconds of arc ahead of the true quadrature position. Since the head rotates through 90 degrees of arc in 1,000 microseconds it can readily be deduced that the equivalent error in timing is 0.09 microseconds.

A test tape is supplied with the RCA recorder, made under controlled conditions, so that there is negligible quadrature error. When this tape is played back on a headwheel with quadrature error, the amount of error in each head channel will be immediately obvious on the monitor, showing as line displacement.

By rotating the appropriate tap-switch on the playback lines till the horizontal displacement disappears, a direct reading of the error existing in that specific head channel is obtained.

The difference between the initial and final settings for adjustment of error represents the amount of delay required to offset the physical displacement from its correct position.

The delay line switches are calibrated in steps of 0.03 microseconds. When a new headwheel panel is installed, the playback lines are set in nominal midrange and, while the test tape is played, the playback lines are adjusted for no horizontal displacement.

The recording lines can now be adjusted for the requisite amount of delay by using an amount of correction equal but opposite to that used in the corresponding playback delay lines. All four video heads are adjusted in the same manner.

Once correctly set, the recording delay lines need no further adjustment until the headwheel panel is changed.

The playback lines, on the other hand, may be adjusted at any time if a tape exhibits quadrature errors when played back. The appropriate tap switches are adjusted until horizontal displacement is corrected. This is quickly accomplished by depressing a short-circuiting button provided on the playback amplifier to identify any given band in a picture with its corresponding head.

DURING OPERATION

All correction is accomplished during operation of the machine and, in fact, correction for recorded error can be made in a matter of a very few seconds after playback starts.

If a mechanical, manufacturing tolerance of plus or minus 15 seconds of arc (plus or minus .045 microsecond) is used in making headwheel assemblies, the maximum timing error between any

QUADRATURE SYSTEM DETAILS

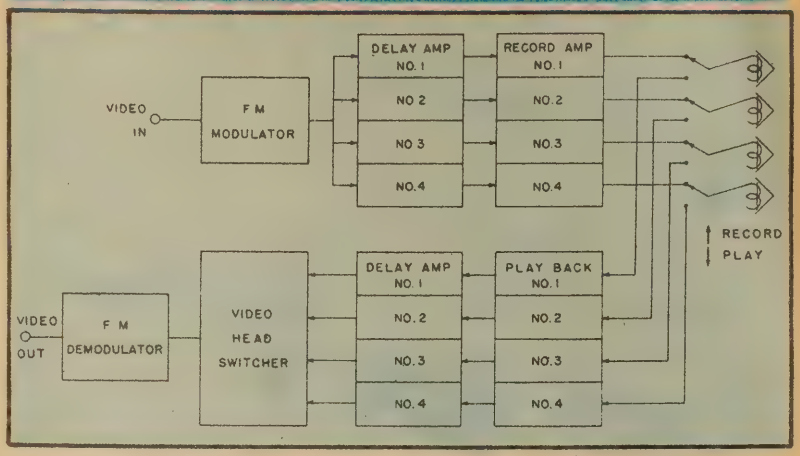


FIG. 1. Simplified block diagram showing the functions of adjustable electronic delay lines used in the RCA TV Tape Equipment.

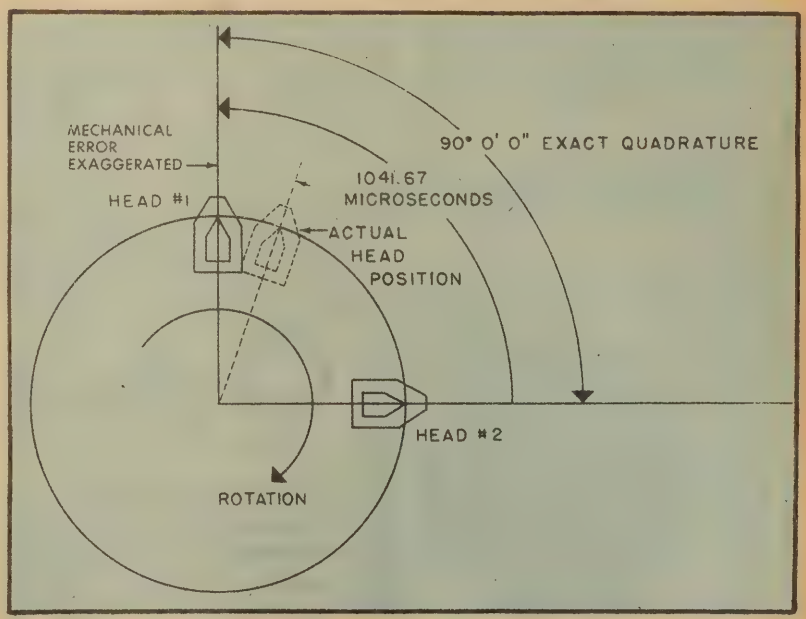
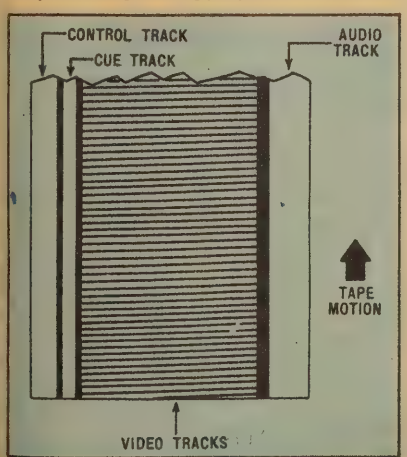


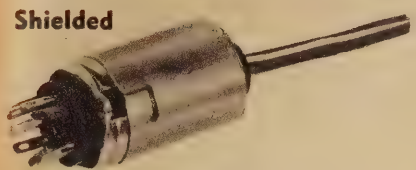
FIG. 2. Functional diagram of headwheel showing the quadrature relationship between two of the heads.



The video recording, on a 2-inch wide tape, is compatible with recordings made on older equipment.

NINE PIN NOVAL PLUG

Shielded



Plug (with cover) and shield only supplied.
Use standard valve socket

Plug (with cover) only

Fits standard 9 pin valve socket. Pins silver plated.
NOTE Lashing Bollard.

N.S.W.: Jacoby, Mitchell & Co. Pty. Ltd.,
469 Kent Street,
SYDNEY

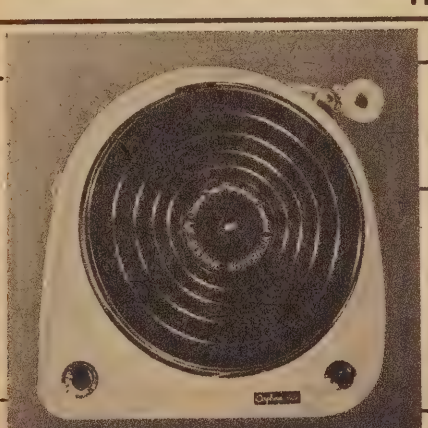
S.A.: Neil Muller Ltd.
8 Arthur Street,
UNLEY

TAS.: Homecrafts (Tas.) Pty. Ltd.,
220 Elizabeth Street,
HOBART

W.A.: D. K. Northover & Co.
115 Murray Street,
PERTH

available from all leading wholesalers and radio parts suppliers

Manufactured by . . .
ZEPHYR PRODUCTS PTY. LTD., 58 HIGH STREET, GLEN IRIS, S.E.6., VIC.
TELEPHONE: BL1300. BL4556.



Orpheus . . . the perfect turntable

A high class unit with professional performance figures that match the world's most expensive turntables, especially with regard to the low level of rumble, wow and flutter. This makes it particularly suitable for stereo work.

"SILEX"

Production of the "SILEX" has been stepped up, as this model is ahead in design and performance and it is commanding attention everywhere

Here are just a few of the details.

1. Motor and pickup isolated from their surroundings so as to completely eliminate rumble, hum and all noise, modulation effects and restricting mechanical feedback. This is guaranteed.
2. Unique engineering design which reduces the total wow and flutter to less than a guaranteed 0.09%, i.e. completely inaudible.
3. Speed settings of 16 2/3, 33 1/3, 45 and 78 r. p. m. constant throughout operation.
4. Pickup mounting adjustable vertically and horizontally, and accommodating any pickup.
5. A moulded rubber turntable mat for maximum traction, with concentric rings so placed as to engage all size records from 12" to 7" by their outer edge: Designed to facilitate easy removal of the record and to reduce dust pick-up by a statically charged record.

See our regular distributors for a demonstration and full technical data.

Australian National Distributors: ***Simon Gray Pty. Ltd.*** 28 Elizabeth Street, Melb. Phones MF 8211, MF 8166

successive pair of heads can be plus 30 seconds (0.09 microsecond).

If a tape is recorded under these conditions, but played back on a headwheel whose corresponding heads are at the other end of the tolerance limit, minus 30 seconds, then the total effective error will be 60 seconds, which is plus or minus 0.093 microseconds or a total of 0.18 microseconds.

By employing 0.03 microsecond taps (10-second arc) on the delay lines, it is possible to set for plus or minus .01 microsecond in each channel. Many subjective tests show that this amount of error is indistinguishable from zero error.

In a 21in monitor, it represents a displacement of .006 inches, which is appreciably smaller than the nominal monitor scanning-spot diameter of .030 inches.

FAULTY TAPES

Electronic quadrature adjustment as provided by the RCA TV tape recorder is very helpful in playing back tapes made on recorders without the advantage of this precision circuitry.

Should band displacement appear on the outgoing monitor, adjustments can be made by visual observation while the machine is actually in operation. In most cases this correction, which is accomplished in seconds, is effective for the entire program run.

While this article has dealt mainly with the quadrature compensation system, the recorder provides all the normal facilities for such an instrument plus the following features:

(1) A continuously variable speed wind-rewind facility.

(2) Air lubricated tape guides.

(3) Cue track which can be recorded and erased independently of the program material.

(4) Suitable for video colour recording.

READER BUILT IT

(Continued from Page 59)

ing a TS34 and 2N291 was built into a separate case with room allowed for the tuner of the car radio to slide in. This made a very sensitive portable with about 100 mw output.

"The method of building the set as two units has proved good and simplified construction and is worth adopting, even if the tuner is not required to also serve for a portable.

"Full battery current of 12 to 14 volts is applied to the 2N250 and the built-in voltage divider supplies approximately 9V to the tuner and audio driver. A 1-amp fuse is inserted in the battery lead. The current is supplied through a low-resistance choke and a hash plate is used.

"A diode is recommended in the live lead to ensure against damage to the set should it be mistakenly connected to a car with reverse polarity. The set is designed for a car with the positive battery lead earthed.

"With transistor sets built up to the same circuit there often appears to be quite a difference in performance. This is due to the fact that transistors of the same type are not exactly identical and also the tolerance of resistors may be sufficiently large to reduce the forward bias. This is most pronounced in the converter, in this case the 2N252 and often a resistor of .5 to .1 megohms across the 47,000 ohms resistor in the bias supply will bring the set up to top performance, or a shunt across the earth arm may be required."

MONTHLY NEWSLETTER

Well, winter is on us with a vengeance now and with it we have noticed a great increase in the number of chaps who have been spending their winter evenings changing over from monaural to stereo. One of the major problems which faces many of them is that, while it is impractical to discard the large sand filled enclosures installed for monaural use in favour of a more compact system, they have insufficient space to duplicate the corner enclosure for stereo work.

After tossing this problem around in our own workshops for many weeks we think we have finally come up with the answer. It involves a little bit of ingenuity and some hard work on the construction part, which would probably tax the average home carpenter's skill to the utmost, but the final results are well worth it.

If any of our readers are interested further we would be only too happy to give them a few ideas on this matter. It is a relatively inexpensive method, as the only actual items to be purchased are the extra speakers, although, with some careful matching and working over on some of the cheaper speakers, even this cost can be reduced.

As hinted last month, we are now in a position to offer a complementary line to our well-known "Graetz" receivers, which we import from Germany. We have been appointed distributors for "Nord Mende," and feel that this is quite an honour, as they are very famous receivers, known throughout Europe for their high quality in every respect.

Slightly different in technical features and cabinet styling, this new range of very beautiful receivers enables us to present a truly magnificent and varied selection of fringe area television receivers, radios and stereophonic radiograms from several of the most famous houses in Europe.

We are finding that there are many "dyed-in-the-wool" enthusiasts who, some five or ten years ago, built their own hi-fi systems and now, due to pressure of business, lack of working space, or in some cases, just laziness, are unable to turn around and start tackling stereo equipment. In this field we have been able to help in many respects in converting monaural systems, or, as many have done, supplying some of our imported equipment by either "Graetz," "Nord Mende," "Braun" or "Blaupunkt," which they have found will fill the bill admirably. It is not the same as walking in and buying a radiogram after being used to hi-fi because these machines are very high quality stereo, bearing in mind that, in Europe, home assembly stereo units are in the minority now, owing to the local release of such high fidelity ready-built equipment at reasonable prices.

In closing, I would like to mention that we have a few items of sample equipment, which have been used in our laboratory once or twice for performance testing which we would like to sell to interested readers on personal inspection only at below our cost prices as we never represent those items as new equipment.

Yours,

UNITED ELECTRONICS (A/SIA) PTY. LTD.

31-33 CAMBERWELL ROAD,

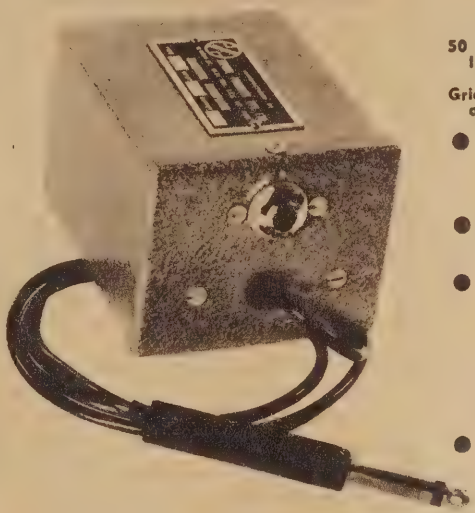
CAMBERWELL JUNCTION **Phone: WB5688**

TRANSISTOR PRE-AMPLIFIERS or LINE TRANSFORMERS

ZEPHYR

IMPROVED TYPE

- *Size 2 1/8" x 2 5/8" x 3 3/16".*
- *Finish: Grey hammertone.*
- *Increases the sensitivity of Dynamic or Velocity Microphones when used with tape recorders and on low gain amplifiers.*
- *Switch jack provides input connector, with the use of a type 150 plug which switches the battery on.*



TYPE 213
50 ohms input to Grid or High Impedance output.
TYPE 214
Grid input to Grid or High Impedance output.

- *Provides greater sensitivity without tonal loss or distortion.*
- *Both types have an approx. gain of 12db.*
- *Model 213 is ideal for use additionally as a line transformer for low impedance microphones to grid impedance.*
- *Long Life Operation on "flat torch" 4.5V battery.*

Supplied complete as illustrated and fitted with one 3703 4.5 volt battery. Price including Sales Tax, £7/1/9.

Manufactured by

ZEPHYR PRODUCTS PTY. LTD. 58 High St., GLEN IRIS, S.E. 6., VIC.

Edels
PTY. LTD.

88 KING ST. BL 1551

FROM HMV, COLUMBIA,

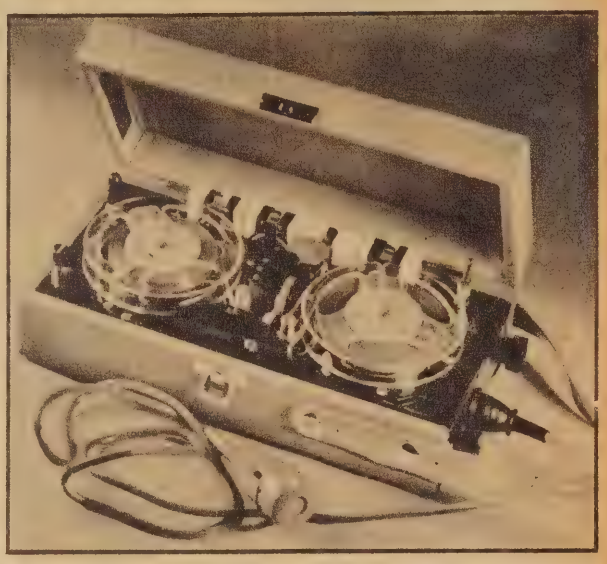
BEETHOVEN: Symphony No. 9 (Choral), Philharmonia Orch. — Klemperer	2 Records	£5/15/-
TCHAIKOVSKY: Excerpts from "Swan Lake" and "Sleeping Beauty" — Philharmonia — Karajan		£2/17/6
BALLET — HIGHLIGHTS FROM THE OPERA: Aida Ballet/Venusberg Music/Dance of the Hours, etc. — Concert Arts S.O. — Leinsdorf		£2/17/6
STRAVINSKY: The Fire Bird — L'Orch. De La Suisse Romande — Ansermet		£2/17/6
HANDEL: Water Music and Royal Fireworks Music, Royal Philharmonic Orch. — Sir Malcolm Sargent		£2/17/6
PROKOFIEV: Piano Concertos Nos. 1 & 3 — Philharmonia — Susskind		£2/12/6
TCHAIKOVSKY: Piano Concerto No. 1 — Gyorgy Cziffra — Philharmonia — Vandernoot		£2/17/6
CALLAS PORTRAYS VERDI HEROINES: Lady Macbeth/ Abigaille/Elvira/Elisabetta Di Valois, etc.		£2/17/6
TCHAIKOVSKY: Symphony No. 4 — Philharmonia — Silvestri		£2/17/6
R. STRAUSS: "Der Rosenkavalier" — Compl. with Schwarzkopf, Edelmann, Ludwig, etc. Philharmonia — Karajan	4 Records	£11/10/-
R. WAGNER: "Das Rheingold" — Kirsten Flagstad, Georg London, Set Svanholm, etc. — Vienna Philharmonia — Solti	3 Records	£8/12/6
BIZET: "Carmen" — De Los Angeles, Gedda, Micheau — French National Radio Orch. — Sir Thomas Beecham	3 Records	£8/12/6
PUCCINI: "Tosca" — with Tebaldi, Mario Del Monaco, etc. under Molinari-Pradelli	2 Records	£5/15/-

FAMOUS IMPORTED STEREOPHONIC CLASSICAL RECORDS

TRADE REVIEWS AND RELEASES

A HIGH-QUALITY BATTERY-OPERATED RECORDER

A small battery-operated tape recorder currently being marketed by Messers Simon Gray Pty. Ltd. incorporates a number of features not found in similar units. It is the "Fi-cord," which is manufactured in England under licence to the original designer, Georges Quellet of Switzerland, who also manufactures the professional version of this recorder, the "Stellavox."



Here is the opened Fi-cord recorder complete with the dynamic microphone supplied normally. Closed, the unit measures 9⅝ x 5 x 2¾, and weighs 4¼ lbs. It can be carried closed while recording.

THE recorder is completely transistorised, and operates from four small rechargeable sealed accumulators. The motor is a 3-volt type, and being electronically governed keeps a constant speed. Incidentally, a switch is included which provides two operating speeds, with a warning light which extinguishes if the batteries are too flat for operation.

The speeds provided are 1⅞ inches/second, for speech, and 7½ inches/second, which provides really good performance on music. The capstan pinch roller can be removed from the capstan when the recorder is not in use to prevent flats forming. For dictation playback it can be finger operated to allow words to be played individually.

PLAYING TIMES

The playing times for the 3¼ inch reels of tape used are 9 minutes per side at the fast speed, and 35 minutes per side at the slow speed. Rewind is carried out by a small handle, as the manufacturers consider that most users will use the unit mainly for recording outdoor interviews, etc., where extensive rewind facilities are not required.

A small lever rests on the tape coiled on the supply spool and operates an indicator on the end control panel, thus showing "tape left to run" when the recorder is being used with the lid closed. The four accumulators fit into a slot in the deck and are held in by clips.

Electrically, the recorder appears to be of high quality and worthy of the maker's "near professional" claim for this type of unit. It employs supersonic erase, is fitted with a cathode-ray level indicator for recording and has a small speaker under the supply spool for on-the-spot playback.

The internal speaker is disconnected when the lid is closed, and can also be turned off when open, if not required. Jacks are provided for headphone monitoring and output to high fidelity playback amplifier for high quality playback. The unit is usually fitted with a small dynamic microphone which incorporates an on-off switch for remote control of the mechanism.

However, for high quality recording the use of the "Grampian" DP.4 microphone is recommended, and using this microphone we were able to get really good results. The recorder retails for £97/17/3 complete with special microphone, two sets of batteries, an automatic battery charger and a spool of Scotch tape.

GRAMPIAN MIC. PERFORMS WELL

AUDIO enthusiasts and other folk associated with recording of music and similar material requiring a high quality microphone will be interested in a unit tested recently in our laboratory. It is the English "Grampian" DP-4 dynamic microphone, distributed in Australia by Simon Gray Pty. Ltd.

One of the "pencil" types of microphone, this unit is slim and light in weight. It is supplied with a tiltable bracket which can be fitted to a normal floor stand or to the table stand supplied (see photograph).

The unit tested appeared to be of very high quality both mechanically and electrically, and performed extremely well. It seemed to fully verify the claim of 50-15000 c/s, without any noticeable peaks. The output is reasonably high for a unit of this type, but is naturally well below that of most crystal types.

Our sample was supplied by the distributors mentioned above, and the retail price is quoted as £23/3/.

ALL TRANSISTOR CAR RADIO

A NEW all-transistor car radio, which uses less current than the dashboard lamps, is being marketed by Philips Electrical Industries Pty. Limited.

The radio, called the "Magic 7," operates on seven transistors and two germanium diodes, which are vibration-proof and last indefinitely.

The "Magic 7's" all-transistor circuit gives these advantages:—

- Instant play, with no warm-up time.
- No hum or background noise because the completely valveless circuit eliminates the need for a vibrator.
- Minimum drain on the battery — 0.55 amps for 12-volt operation and 0.93 amps for 6-volt operation—75 per cent less than with valve car radios.
- Completely reliable long-range reception and high undistorted output.
- Fingertip tone control.
- "Stay-put" tuner which keeps station frequency on the roughest roads.
- Peak performance in all climates — test-proved at temperatures of 180 deg. F.

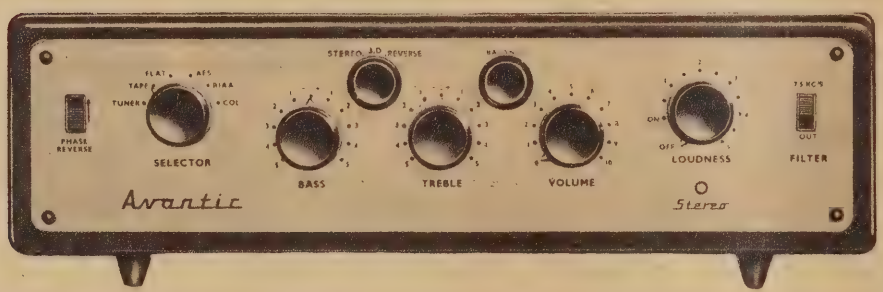
The "Magic 7," which is entirely manufactured at Philips' Hendon (S.A.) factories, has been designed for all models and makes of car, and retails at 49 guineas, complete with telescopic aerial.

new for Stereo

NEW FROM ELAC
TWO REVOLUTIONARY VARIABLE RELUCTANCE STEREO CARTRIDGES

STS 210D .7 MIL CARTRIDGE • STS 310D STUDIO .5 MIL CARTRIDGE

Technical Data:	STS 310 Studio	STS 210
Frequency range:	20 . . . 20,000 cps	20 . . . 18,000 cps
Sensitivity on each channel at 1000 cps:	20 (mv/10 cm sec-') eff	25 (mv/10 cm sec-') eff
Cross-talk at 1000 cps:	24 db	22 db
Impedance:	approx. 1000 ohm per channel	approx. 1000 ohm per channel
Inductance per channel:	650 mh	650 mh
Recommended terminal impedance:	33 . . . 51 kohm	33 . . . 51 kohm
Effective mass on stylus:	approx. 1.9 mg	approx. 2.2 mg
Radius of stylus tip:	0.52 mils	0.68 mils



SPA21 STEREOPHONIC AMPLIFIER

Traditional English quality plus American styling

SPECIFICATION

Power output (each channel): 25 watts peak (speech and music condition). **Distortion** (each channel): 0.1% total harmonic at 10 watts. **Frequency Response:** 40c/s.-15Kc/s. ± 1dB. **Cross Talk:** Better than 40dB channel-to-channel. **Rumble Filter. Loudspeaker impedance:** 4 Ω, 8 Ω and 16Ω. **Tape recorder output:** 50mV. **Controls:** 6-position input selector; continuously variable bass and treble controls; volume control; Loudness control and On/Off switch; Stereo/3D/Reverse-stereo switch; stereo phase switch; low-pass filter switch; stereo balance control. **6 inputs for each channel. Input sensitivity** for 10 watts output: Tuner: 100 and 250mV. Tape: 3.5mV. (compensated to C.C.I.R. characteristic); Flat; 250mV.: Pick-up: 5 and 50mV. **Mains voltage:** 110-117; 200-220; 230-250V. a.c. 40-60c/s. **Dimensions:** 14½" wide x 14" deep x 4" high

HEATHKIT VTVM MODEL V-7A

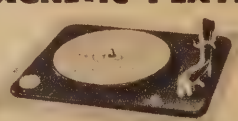
D. C. and A.C. volts to 1,500, 0.1 ohm to 1,000 mohms, input impedance 11 mohms. Also peak-to-peak scales for TV service, etc. R.F. and high-voltage probes also available. Other HEATHKITS in stock. **Price, £27/10/-, plus tax.**

NEW PIONEER SPEAKER RANGE

8" Coaxial, £11/2/6. 15" Coaxial, as illus., £49.

Coaxially mounted tweeter. The 8" model rated 8 watts, 15" at 25 watts. Both capable of reproduction from 30 to 18,000 cycles.

ELAC 210 STEREO MAGNETIC PLAYER



Balanced motor with heavy cast and machined table. Low rumble, fitted with world-famous ELAC magnetic cartridge. Available with metal base for bookshelf use. **Price, £52/10/-.**

Write or call—

Hi-Fidelity Sales

158 Clarence St., Sydney, BX5127

VICTORIAN DISTRIBUTOR: V. BRULL PTY. LTD.

E824

NEW METER FROM UNIVERSITY GRAHAM

Released recently by University Graham Instruments Pty. Ltd., a new clear-faced acrylic series of meters should be of considerable interest to engineers, instrument manufacturers and home builders.

DESIGNATED the W2 series, the meters are rectangular faced, 2 7/16in x 2 5-8in, and have a 2.5-inch 90-degree scale. The acrylic case is petrol impervious and craze-resistant, and can be supplied dust sealed. Both spade and knife edge pointers are obtainable.

The W2 meters are available in moving coil types only, with sensitivity ranging from 30 uA to 50 amps with internal shunts and higher with external shunts. Voltmeter versions are available up to 1,000 volts self-contained.

Other types of meters available in the W2 series include AC rectifier type voltmeters, dB and level meters, and RF meters. The meter pictured is the level meter, as used in the current tape recorder.

The meters are available through the normal trade houses and suppliers. Further information, if needed, can be obtained from the manufacturers, University Graham Instruments Pty. Ltd., of 5 York Street North, Sydney.

R. W. STEANE TO BE PUBLIC COMPANY

R. W. STEANE, LTD., makers and distributors of electronic components, was registered in Melbourne last week with a nominal capital of £500,000 in 5/ shares.

Formerly R. W. Steane and Co. Pty. Ltd., the company plans to issue £60,000 of unsecured notes with separate options to take up ordinary shares at par. The issue will be handled by Messrs Walter P. Ham and Co., members of the Stock Exchange of Melbourne.

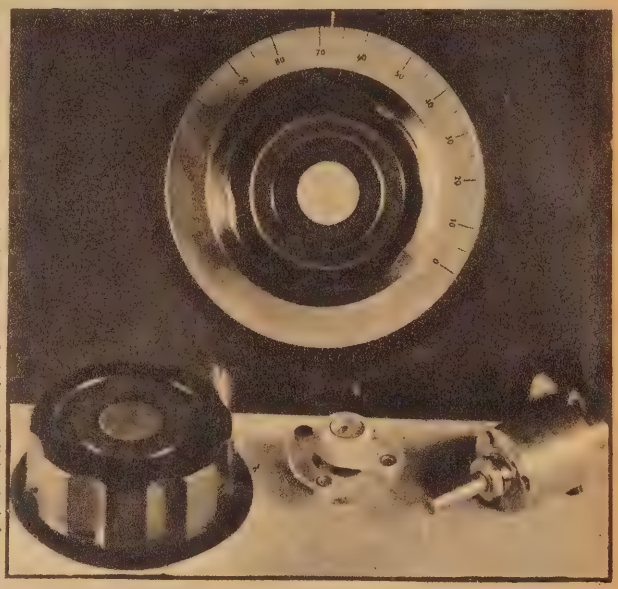
The company expects to seek listing on the Stock Exchange in 12-18 months.

Directors are Messrs R. W. Steane (chairman and managing director), F. Owen, J. Winkelman and L. G. Brown.

R. W. Steane is now one of the world-wide chain of licensees for the manufacture of the world-famous Standard Coil (U.S.) television tuner.

COMPONENTS — WATKIN WYNNE

Several small items recently announced by Watkin Wynne Pty. Ltd. will be of special interest to readers planning to construct test equipment. The items are illustrated below.



AT the bottom left is a large 3in skirted knob made from black polyresin, with a brass insert and carrying two grubscrews for locking to the shaft.

The knob can be supplied to fit either ¼ or ⅜in shafts. Four holes are provided at the rear of the dial, ready drilled and tapped, to facilitate attachment of a cursor or dial plate.

If a dial plate is required, the same firm can supply the plate as shown, with black detail on a silver background.

At the bottom right is a new precision vernier drive assembly. Of the planetary type, it contains three sets of ball bearings and gives a reduction ratio of 10:1.

Actually the knob, drive and dial plate can be combined to produce an excellent instrument type dial with a vernier action between the knob and dial scale.

Another interesting item, as illustrated, is the insulated flexible coupler. This has an alkathene centre suspension for good insulation and flexibility, the "spiders" being of polystyrene. The spiders contain brass inserts with twin grubscrews, to ensure positive locking.

The couplers are available for ¼ to ¼in spindles, ¼ to ⅜ and ⅜ to ⅜.

These various items should normally be available through trade houses. Trade inquiries may be directed to Messrs Watkin Wynne Pty. Ltd., 21 Falcon Street, Crow's Nest, N.S.W.

AUSTRALIAN SUBSIDIARY FOR COLLINS RADIO

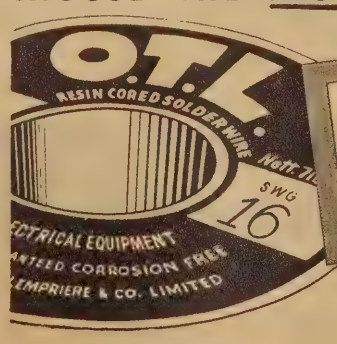
THE formation of an Australian subsidiary company to promote the sales and service of Collins Radio Company equipment was announced by James G. Flynn jun., vice president.

The new subsidiary, Collins Radio Company (Australasia) Pty. Ltd., located at Stanhill, St. Kilda Road, Melbourne, Victoria, Australia, will serve Collins customers in the Australian, New Zealand and South East Asia area.

A spare parts service centre and complete test facilities employing factory-trained technicians for Collins equipment will be maintained by the new company.

Officers of the new subsidiary include James G. Flynn jun., E. F. Coate, John H. Boyle and R. C. Frost.

CHOOSE THE BEST—IT COSTS NO MORE



Resin Core SOLDERS for reliable connections

O. T. LEMPRIERE & CO. LIMITED
Head Office: 27-41 Bowden Street, Alexandria, N.S.W.
and at Melbourne • Brisbane • Adelaide • Perth

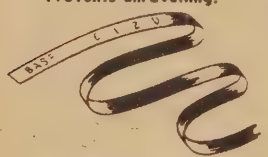
BASF gives you all these extras!

BASF

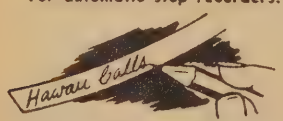
Has the performance to meet the rigid specifications demanded by these users.

The Australian Broadcasting Commission
The Royal Australian Air Force
The Department of the Army
The Department of the Navy
100 Commercial Stations
The Department of Civil Aviation

RED SAFETY CLIP
Prevents unravelling.

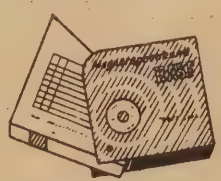


THE METAL FOIL STRIP
For automatic stop recorders.



THE GREEN AND RED LEADER
To write your titles on.

THE FACTORY SEAL. Your guarantee of brand-new tape.



THE SWIVEL BOX
Never loses the lid.

World-famous BASF Magnetic Recording Tape is now available in all these sizes:—

STANDARD	PRICE
600' on 5" spool	35/-
1,200' on 7" spool	59/6
LONG PLAY	**PRICE**
213' on 3" spool	15/-
850' on 5" spool	44/-
1,200' on 5¾" spool	59/6
1,800' on 7" spool	79/6
DOUBLE PLAY	**PRICE**
1,600' on 5¾" spool	£4/10/6
2,400' on 7" spool	£6/ 7/6

AUSTRALIAN DISTRIBUTORS:

Maurice Chapman & Co. Pty. Ltd.

Brisbane:
Chandlers Pty. Ltd.
Perth:
Athol M. Hill

Melbourne:
Homecrafts
Radio Parts Pty. Ltd.
Warburton Franki Ltd.

Adelaide:
L. S. Wise Ltd.
A. G. Healing Ltd.

A836

B. & O. MAGNETIC PICKUP CARTRIDGE

The pickup cartridge pictured below is a magnetic variable reluctance type, manufactured in Denmark by the firm of Bang & Olufsen. It was submitted for test by Messrs. Radio Parts Pty. Ltd., of 562 Spencer St, Melbourne.

ACCORDING to literature on the pick-up, it employs a balanced 4-pole design, which ensures symmetrical behaviour on the respective stereo channels, good channel separation and complete noise cancellation when used for mono.

While we have had opportunity for only limited tests on the cartridge, to date, our observations indicate that the overall performance is excellent. Chan-

nel separation is good at all frequencies and quite close balance is maintained throughout the range.

The waveform is generally good and the response free from obvious peaks or troughs. Our tests indicated a gradual rise in output towards 40cps and in the 10-12Kc. region, when playing a standard test recording through a typical compensated pre-amplifier.

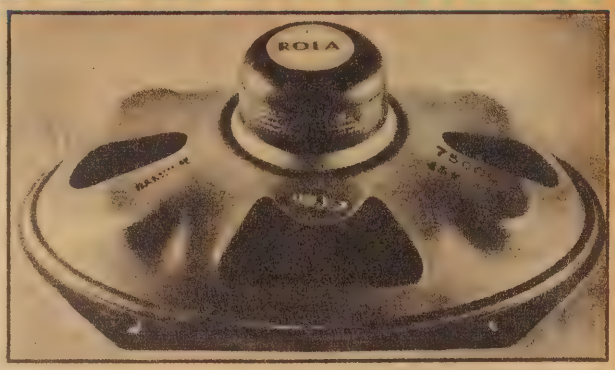
On ordinary discs, output was ample to drive a "Playmaster" system when using our latest high-gain Control Unit. The use of mu-metal shielding and a "hum-bucking" connection of the coils renders the cartridge insensitive to external magnetic fields.

Specified tracking force is 2 to 4 grams, moving mass less than 3 mg. and compliance 5 to 10 to the power —6 cm/dyne in all directions.

A diamond stylus is fitted as standard and the price is quoted as £14 retail.

NEW 15-OHM OVAL LOUDSPEAKER

LATEST release from the Rola Company, pictured here, is the 7in x 5in oval speaker, type 75C.



Conforming to the present trend, this new speaker has a 15-ohm voice coil. It can be supplied without transtormer, or with the manufacturer's "Q" type, to the required primary winding impedance.

As sold over the counter, it will be fitted with the maker's F45 cone, giving a bass resonance in the vicinity of 90cps and a substantially smooth response above that figure.

Physically, the new speaker resembles the previous types 75H and 75L, previously known as the 5-7H and 5-7L. However, it differs in that the earlier types were fitted with 3.5-ohm voice coils.

The 75C has a smaller magnet structure than either the "L" or "H" types and is slightly less sensitive as a result. However, the sensitivity is ample for television receivers, etc., and the saving in cost is worthwhile.

Retail price of the 75C, including tax, is 44/3. It is available freely from radio trade houses.

Choose from 393,216 High Fidelity systems (Stereo or Mono) on the fabulous "Wall of Sound"

Jason, Leak, Quad, Rogers, Myer, Aegis, Tannoy, BTH, Wharfedale, Peerless, Goodmans, Barker, Magnavox, Thorens, Garrard, Connoisseur, Dual, Grundig, Ferrograph, Philips, Decca, G. E., Ortofon, Acos, Ronette, etc. Also cabinets and enclosures.

MASTERSOUND

Lido House, 400 Kent St., Sydney (Round the corner from Market St.). BX 2977

MAKING A TRANSISTOR PORTABLE?

TRANSPORTA 4

Complete Kit of Parts for Transporta Four as featured in October Radio and Hobbies, including Cabinet as used with the Transporta.

£16-17-6

LESS CABINET, £14/7/6.

Most parts used in the Transporta Four can be used for the Transporta Seven should a larger set be required at a later date.

NEW 6V RECORD PLAYER, £7/15/-

These new 4-speed Record Players are supplied with turnover crystal pick-up and sapphire needles, and are suitable for use with the above or any transistor radio. Postage and packing extra. N.S.W. 10/; Interstate 15/-.

COMPLETE KIT OF PARTS for the TRANSPORTA SEVEN

£25/17/6 SET WIRED AND TESTED £2/10/- EXTRA

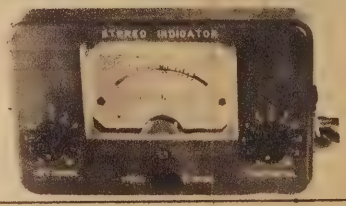
Complete kit of parts for the Transporta 7 as featured in Radio and Hobbies, including 7 S.T.C. Transistors, Printed Circuit Boards, Coil Kit, Rola 5F Speaker and Transformers and all necessary parts to complete this set including attractive and durable two-tone cabinet with gold trim. Fitted with special aerial coil and plug to connect to your car aerial or external aerial making it an ideal car set or for use in the country.

POSTING AND PACKING EXTRA on transistors 4 or 7 sets. } **N.S.W., 15/-. INTERSTATE, 22/-.**

STEREO AND AUDIO LEVEL INDICATORS

Designed for checking balance in stereo amplifiers or checking output of stereo or monaural equipment. Can be used as output meter. Simple to use, connect across voice coils of speakers. **£3/18/6**

Post and Packing: N.S.W., 3/6; Int., 5/6.



NEW 12in PER MAG SPEAKERS

These Standard Speakers by leading manufacturer (we cannot advertise the make) are supplied less transformer.

47/6 Packing extra. **Post, N.S.W. 10/-; Interstate 12/6.**

9in x 6in OVAL SPEAKERS

37/6 **Post, N.S.W. 7/6; Interstate 11/6. Plus packing.**

Transformers for above speakers 5,000 or 7,000 ohms, 10/-.

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt, at 4 amp, 37/6.

Post, N.S.W. 7/6; Interstate 10/-.

Transformer for above rectifier tapped for 6 or 12 volt, with circuit for charger, 47/6

Post, N.S.W. 7/6; Interstate 10/-.

TAPE-RECORDER MOTORS

New Collaro Tape Recorder Motors, 240 volt. A.C. Adaptable for many uses. **37/6** Post extra.

CONDENSER SPECIALS

Boxes of 100 new ceramic, mica, paper and electrolytic condensers in values ranging from 50pf mica to 5 400v paper. Values include .0001, .00025, .00075, .02, .05, 1. Also 500 mfd/12v., 8 mfd 525v., 16 mfd 350v., electrolytics.

25/- per 100.

Post Extra: N.S.W., 2/6; Int., 3/6.

CONDENSER SPECIALS

100 new mica paper and ceramic condensers, mixed values.

15/- Post 2/.

NEW I.R.C. RESISTORS

I.R.C. carbon resistors, ½, 1 and 2 watt, in values 5 ohms to 5 meg., including many popular sizes. 3T, 15T, 20T, 50T, 100T, 250T, 500T, etc.

(Standard resistor colour code supplied.)

100 for 25/-. Plus 1/6 postage.

NEW METER RECTIFIERS

Westinghouse 1 mA rectifiers, 15/.

ELECTROLYTIC CONDENSERS

New Dubilier pigtail condensers.

8mfd 525v 2/9

16mfd 600V 5/9

Post Extra

TV OR AMPLIFIER POWER TRANSFORMER

240v pri., sec. 260 x 260, 250mA. 6.3 v windings.

£3/15/0 F.O.R.

(To heavy for post.)

80 M.A. TRANSFORMER

240v pri., sec. 285 x 285, two 6.3v fil. windings.

32/6

Post: N.S.W., 5/; Int., 8/6.

NEW POWER TRANSFORMERS

60mA prim.: 240v with 230v tapping. Sec. 285. x 285 with 6.3v filament winding 60mA.

25/- Plus postage, N.S.W. 3/6, Int., 5/3.

NEW MIDGET POWER TRANS.

40mA prim., 250v. Sec. 225 x 225 with 6.3v Fil. Winding.

25/- 2/6 Postage, N.S.W., Interstate, 4/6.

30mA 240v Prim. 150 x. 150v. Sec. with 6.3 v Fil. Winding.

22/6 Postage: N.S.W., 2/6 Interstate, 3/6.

MICA CONDENSERS

Standard Mica Condensers, small current types .00003 and .005, including most wanted values.

10/- Postage 1/6. per 100.

CARBON RESISTORS

New carbon resistors, mixed values. Well-known make. **10/ per 100. Post free.**

NEW POTENTIOMETERS

with SWITCH STANDARD SPINDLE	WITH SWITCH SHORT SPINDLE	LESS SWITCH STANDARD SPINDLE	LESS SWITCH SHORT SPINDLE
25,000 ohms	100,000 ohms.	100,000 ohms.	50,000 ohms.
100,000 ohms	500,000 ohms.	500,000 ohms.	100,000 ohms.
500,000 ohms	2/6 ea. 24/ doz.	500 ohms.	500,000 ohms.
4/6 ea. 42/ doz.		5,000 ohms.	
		3/6 ea. 33/- doz.	1/9 ea. 16/ doz.

25,000 ohm screwdriver adjustment, 1/9.

500,000 ohm pots can be supplied tapped at 40,000 if required, post extra.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. Phone LM7398

SPECIAL PURCHASES!

New 5 Valve Dual - Wave Radiogram Chassis

THESE NEW DUAL WAVE RADIOGRAM CHASSIS MADE BY LEADING MANUFACTURER ARE EQUIPPED WITH LATEST MINIATURE VALVES AND SUPPLIED WITH 12in ROLA SPEAKER.

£16/15/- F.O.R.

PACKING 10/- EXTRA

NEW 4 SPEED RECORD CHANGERS

THESE NEW 4 SPEED RECORD CHANGERS ARE EQUIPPED WITH HIGH FIDELITY CRYSTAL PICK-UP AND SAPPHIRE NEEDLES. CAN ALSO BE USED AS A MANUAL PLAYER.
SUITABLE FOR USE WITH ABOVE RADIOGRAM CHASSIS. F.O.R.

£10/15/-

DUAL CONCENTRIC SWITCH POTENTIOMETERS

500,000 ohms plus 10,000 ohms, also
500,000 ohms plus 1 megohm.
Long spindle.
10/-
POST FREE.

NEW 4in PER-MAG SPEAKERS

5T or 7T Trans.
25/-
Post and Packing, 3/6.

HIGH IMPEDANCE HEADPHONES NEW 27/6

Post 2/6.

STANDARD INTERMEDIATE FREQUENCY TRANSFORMERS

455Kc. 1¼in square cans. Slug tune.
4/9 post extra.

NEW 4-SPEED PLAYERS

With turnover Crystal Pickup

£8 POST N.S.W. 7/6
INTERSTATE 12/-

NEW 4-SPEED STEREO PLAYER -- -- -- -- -- -- £12/10/-

NEW STEREO CHANGER 4-SPEED. F.O.R. -- -- -- -- £17/10/-

PILLO-FONE EXTENSION UNIT

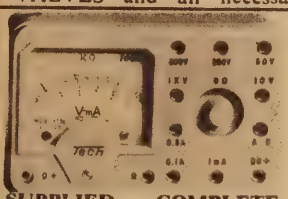
IT'S A REAL MINIATURE WITH ROLA UNIT

Install it anywhere, in the sick room, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED.
3½in Diameter by 1¾in deep.
POST FREE. **22/6**

COMPLETE KIT OF PARTS FOR THE HI-FI "PLAYMASTER" STEREO AMPLIFIER

As featured in April issue of R. and H. including TWO ROLA 8MX SPEAKERS.
Parts include chassis and case. FERGUSON OUTPUT TRANSFORMERS.
VALVES and all necessary parts.

£32/10/ f.o.r.



SUPPLIED COMPLETE WITH TEST LEADS

NEW MULTIMETERS — 61/- POST EXTRA

METER 0-1mA 1000 OHMS PER VOLT

A.C. RANGES	D.C. RANGES	CURRENT RANGES
0—10v	0—10v	0—1MA
0—50v	0—50v	0—100MA
0—250v	0—250v	0—500MA
0—500v	0—500v	
0—1000v	0—1000v	

OHMS RANGE 0-100,000 OHMS.

NEW VALVES AT BARGAIN PRICES

6J6	12/	6K8G	6/9	1C7G	3/	6SL7	10/6
ECH 35/VR99A. Direct replacement for 6J8G	10/	6SJ7GT	9/6	1K5G	2/6	6H6GT	2/6
1C4	7/6	12K8	10/	1M5G	3/	6K7GT	7/9
1T4	4/6	EK32	6/9	1K7G	3/	6U7G	5/
3S4	10/	6SA7GT	9/6	1L5	9/6	6J7G	5/
1R5	10/6	6SH7	5/6	6C8G	5/	7C7	3/6
1A7GT	9/6	105G	4/	6SS7	8/6	78	7/6
1D8GT	9/6	1P5G	2/6	6H6	2/6	EL32	10/6
6A8G	10/6						
6AC7	3/6						

6B6G VR55	3/	6V6GT	12/6
6J6	12/	VR65A	2/6
6V6GT	12/6	41	7/6
VR65A	2/6	7193	2/
41	7/6	12A6	7/6
7193	2/	EF50	2/6
12A6	7/6	12SH7	5/
EF50	2/6	6K7G	4/6
12SH7	5/	1C6	7/6
6K7G	4/6	955	2/6
1C6	7/6	954	2/6
955	2/6		
954	2/6		

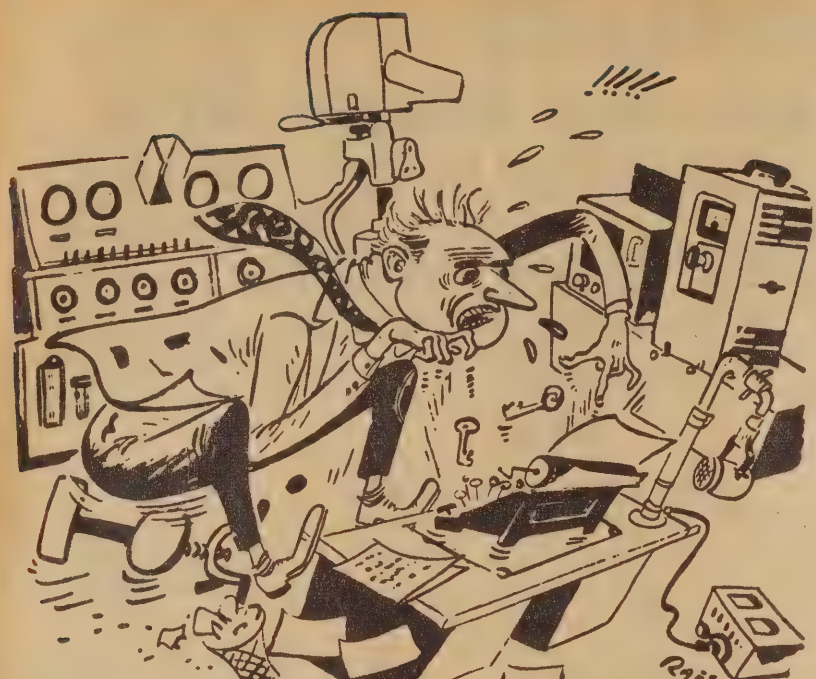
SPECIAL PRICES FOR QUANTITIES.
Please add postage on all valves.

NEW VALVE SOCKETS: Ceramic EF50 sockets, 2/6 ea. American moulded Loctal, 1/ ea. Octal 8-pin wafer, 6/6 doz. 5BP1 socket Ceramic, 7/6. Amphenol 5-pin ceramic, 2/6 ea. All post extra.

NEW MINIATURE COILS and I.F. TRANSFORMERS: Aerial, R.F. or Oscillator Coils, 7/6 ea. Post 1/-. I.F. Transformers, 9/6. Post 1/-. Short Wave Coils, 16 to 49 metres, 5/6 ea.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. Phone LM7398



Let's Buy An Argument

A Tasmanian reader raises a question which I can't recall having been discussed before in these columns. As you can see for yourself, he wants to know the reason for the difference between the so-called "English" and "American" styles of circuit presentation. Further, why we apparently prefer the latter.

by Neville Williams

I ONLY hope that this isn't supposed to be an extension of the earlier rather futile and misplaced "English v. American" argument. I can only hasten to assure our correspondent that any conscious decision along these lines was not taken on a "nationality" basis but simply as a result of natural evolution and preference.

OBVIOUS DIFFERENCE

As he points out, however, there is an obvious difference in the basic presentation of circuits by different magazines throughout the world.

Most English magazines put the high tension line at the top, valves along the centre and an earth line along the bottom. As a result, plate and screen resistors run upwards towards the supply line, while grid and cathode resistors, together with most bypasses run downwards towards earth.

They therefore create "visual gradient" from B-plus to earth.

Most American magazines tend to range the valves and major coupling components along the top, then drop all supply and bypass components away from them and towards horizontal lines representing B-plus, AGC and sometimes earth. In some cases, the earth line is replaced by a multiplicity of earth symbols simply indicating "chassis."

There are exceptions to this "rule," however. One occasionally sees English circuits drawn in the so-called "American" style, while the American magazine "Audio" seems to contain a lot of circuits "English" style.

Just to be different again, some French draughtsmen draw their circuits American fashion but put the valves on their sides so that the supply wires drop straight away to the lines underneath.

I doubt, personally, that any one method has all the advantages. For some circuits, the English system looks delightfully straightforward. Supply components drop straight down from B-plus, while bypasses continue, in the same vertical line, to earth. In a sense, the "DC" circuit is presented vertically, while the signal path progresses from left to right.

But there are plenty of circuits where the system tends to produce a very clumsy result. It can happen, for example, in circuits involving a large number of double wound coupling coils or transformers.

LONG LINES

Practice seems to be to elevate the said coils or transformers so that the primary lies between the plate of the preceding valve and the HT supply line. Since the secondary then has to be drawn adjacent to it, quite long leads are involved to get back down to the earth and bias lines.

And the circuit looks even more complex if, following the "gradient" idea, the draughtsman insists on placing AGC or other negative circuitry below the heavy earth line. This is no figment of my imagination; I am looking at just such a circuit as I write.

Involved push-pull circuits present another "hazard" of the English system, because it is impractical to observe the gradient requirement and maintain symmetry at the one time.

And what of transistor circuits? Should the gradient be reversed or the whole circuit be drawn "upside down?"

American practice minimises some of these difficulties, in that it facilitates symmetry in push-pull circuits, conserves space and, by closely grouping valves and coupling components, allows the diagram to be laid out like a "fully wired block schematic."

But I agree that, for simple component groups, notably multivibrators, bridges, etc., it lacks the impact and clarity of the other system.

LOCAL CUSTOM

It so happens that most Australian draughtsmen have elected to follow the American method and we do likewise. But we are certainly not one-eyed about it. If we feel that a circuit is more graphically depicted by putting the B-plus line at the top, well, to the top it goes!

In my opinion, the important point is not so much the general method, but the individual treatment. Using either method, a draughtsman can make a circuit very easy or very hard to follow.

simply by the way he maintains visual lines, and arranges the position and spacing of components.

Ideally, the stages in a circuit should follow the signal path as far as possible, in natural sequence, from input to output. Components relevant to each stage should be grouped together and the whole separated by a slight space from the next component group. If this is done carefully, what might easily be a tangle of lines, breaks up visually into a series of circuit blocks, recognisable as individual stages.

KEEP LINES STRAIGHT

Important supply lines should run boldly through the circuit, with a minimum of meandering hither and yon.

And, incidentally, the requirements for a good circuit for magazine reproduction are completely different from one intended for blueprint copying.

The lines must be heavier so that, when reduced for printing, they will still have adequate "weight." Space has to be utilised to the full. Circuits of any style, drawn to "blueprint" practice look just terrible when reduced for reproduction in a magazine. Lines are "spidery" and there is usually far too much unused white space.

I say this merely to forearm the many readers who will have had drawing-board experience and may tend to base thereon judgment of magazine circuits.

Since confession is allegedly good for the soul, I should perhaps round this section off by a story told at my own expense.

As a much younger man, I was charged with the responsibility of drawing a receiver circuit for a valve application laboratory. Having made sure about utilising space to the full and using thick lines, the circuit was duly drawn and published.

It was also reprinted, with comments, in one of the then local radio journals. Among other things, reference was made to "the rather involved AVC system."

QUITE STANDARD

In fact, the AVC system was perfectly standard. It was just that my drawing had made it look involved! It took me many months to live down the reputation for producing sets with involved AVC systems.

But at least the lesson was driven home and the next circuit was notable, by contrast, for the number of straight lines it contained!

What's more, the lesson lives on, being practised daily by our staff member, Mervyn Huddlestone. While we obviously can't please everyone in the configuration of our circuits, at least we do try to keep them tidy and easy to follow.

This I must add. You'll know that I've given the game away, if ever you see one of our circuits following the lamentable practice of omitting the ring around valve elements. It gives me the "horrors" to see wires seemingly run to disembodied resistors or single-plate capacitors!

Under the heading, "Why All The Fuss?" a reader from Mona Vale, N.S.W. has something to say about stereo. I suspect that he is being a trifle modest because, after all, it takes a certain amount of know-how to adapt and string together a couple of discarded receivers, and to get them working as well as he apparently has done.

However, that is by the way.

I must confess that I have not seen the literature attributed to the two record clubs in question. If the position is exactly as represented, it would better be described as "tragic" rather than merely "amusing."

While it may be possible to play a stereo record with a mono stylus, it certainly would not be in order to play a stereo record with such a stylus contained—as it almost certainly would be—

WHY ARE CIRCUITS DIFFERENT?

Dear Sir,

Is there a logical reason for preference for either of the two accepted methods of drawing radio circuits? For want of a better name, I will call them the "American system" and the "English."

The former, which is the one you favour, shows the power pack tucked away at the bottom. The B-plus line wanders around, mixed up with AVC circuits, feedback systems etc., while earth symbols are scattered over the whole diagram.

In the English system, the H.T. line is at the top, the earth line is very heavily printed near the bottom and the power pack is at the right hand side feeding directly into the rest of the circuit.

The biggest disadvantage of this seems to be that the radio "hot" components lie in the centre of the diagram and get "colder" either up or down — but this is still a fault in the American system with the added trouble of B-plus lines running up alongside the valves, grid coils, etc.

In a complicated, or unfamiliar, circuit it is often very difficult to trace the action of the circuit and I frequently have to redraw the relevant portion to the "English" method to sort out which current flows which way! As I was brought up on the English system I am probably prejudiced!

To be really logical I suppose we should devise a new symbol for the radio valve in which the grid is taken out at the top, the anodes at the side, etc.

This would place the "hot" ends of components at the top, the H.T. right through the middle and the earth and "cold" circuits at the bottom; then we would all be confused!

Anyhow, what is the reason for the two systems?

Yours faithfully,
G.F.C.

★ ★ ★

WHY ALL THE FUSS?

Dear Sir,

As a layman without special qualifications and with only a limited knowledge of the intricacies of circuitry, I feel that I would like to add my comment to the recent letters and articles on stereo, in your magazine, and others.

It is interesting — and amusing — to read comment from two of Sydney's record clubs. Club (A) states "Double speakers and separate amplifier enclosure are a must" and record changers are taboo for stereo records.

Club (B) reveals that separate speakers are out, the single unit being the thing to have; club (B) also markets STEREO records that can be played with a MONAURAL stylus.

Meanwhile your correspondents are arguing about how to eliminate the "dead spot" in the centre. What is this "dead spot" everyone is worried about?

My stereo setup does not have a "dead spot" and it had never been evident in any of my varied collection of stereo discs.

Perhaps you are thinking, this is due to the chap having a real "humdinger" of a setup — but no, I wouldn't know a tweeter from a woofer or a crossover system from a crystal set. The impressive array of components that make up my system are as follows:—

Two "butchered" radio sets with everything bar amplifier and power supply cut away—cost £5 each; output and frequency range unknown and of no consequence.

One 12-inch speaker in one 2ft x 2ft square 5-ply cabinet (type and impedance unknown).

One 8in and one medium-sized oval speaker (ex-car radio) in cabinet of same dimensions; again details unknown. Total cost about 50/ the lot.

Record Player — Philips "Disc Jockey" with stereo head and weight conversion — Rumble Wow, Flutter? Wouldn't know if I heard it. Never worried by it, whatever it is.

Results? Fantastic. When people are supposed to sing from the left, right or centre they do so, without dead spots or any other trouble.

Two Radio and TV retailers have heard my system and declared it better than any commercial type available up to £150. One remarked that I had the advantage of two entirely separate channels with push-pull (whatever that is) and separate volume and treble controls.

It seems to me that the gentlemen who are so concerned about their woofers and tweeters, frequency responses and turntable rumble, are unable to see the stereo "trees" for the high response system "forest."

Yours faithfully,
K.F.W.

"THE FINEST IN THE WORLD"
—*the Orchestra in the living-room!*

Every gramophone from cheap commercial stereos to the most mediocre of custom equipment seems to make similar claims.

Our **INTERGRAND** system of matching units is designed in each price level to meet the highest musical and technical requirements and not just to give 30-15,000 cycles of raucous and strident sound.

We would prefer to quote the opinions of the more knowledgeable and reliable critics who are not comparing by value for money but by adherence to a standard.

WHARFEDALE

Columns complete with 8/145 speakers. "We can recommend this loudspeaker to our most critical listeners." Hi-Fi News.

INTERGRAND 8 watts per channel, less than 0.3 p.c. T.H.D. Complete with all desired facilities.

ORPHEUS TURNTABLE

5-year guarantee of its low rumble level.

DECCA FFSS

"There is not one I should say is better." Percy Wilson. "The Gramophone."

We are not ashamed to disclose our prices. The unit shown costs complete with cabinets finished to taste only **£165** Other units can be supplied by quote from **£95** for a unit consisting of two Wharfedale columns. Garrard 4-speed c/w Acos Stereo diamond and A and R Mullard 2/2 amplifier, all completed and working. Our units are designed to blend with furniture and to allow the music-lover to know what his unit will look and sound like without the risky method of buying unrelated pieces.

However, for those unable to see and hear our units we offer a postal advice service which gives genuine advice and not just laudatory advertising leaflets.

We are suppliers of all recognised high grade equipment such as—

LEAK
WHARFEDALE
ORTOFON
ACOS
CHAPMAN
FERROGRAPH
TANDBERG
and many others.

Take advantage of our generous trade-ins on your old equipment to obtain a unit that can be listened to without apologies

Appointments can be arranged day, night or weekends to suit your convenience.

ENCEL ELECTRONICS

Trade and Retail Suppliers

ENQUIRIES:—354 BRIDGE ROAD, RICHMOND—JB2820

(5 MINUTES FROM FLINDERS STREET)

SHOWROOMS:—361 BRIDGE ROAD

in a mono pickup of indeterminate make and type.

A great many mono pickups had very limited vertical compliance, which simply means that they would rapidly disfigure the groove.

It may be — and has been — argued that this effect could be minimised by reducing the amplitude of the vertical component, but this would automatically involve a reduction of the very stereo effect, for which the disc was originally bought.

It looks to me as though somebody has got something very badly tangled.

LITTLE TO ADD

As for the rest of the letter, I doubt that there's much that I can add. Having respect to the elementary nature of some commercial single-cabinet radiograms, it is not surprising that something contrived out of discarded push-pull audio systems sounds better, especially when feeding into separate and reasonably baffled speakers.

But, in their turn, "the gentlemen who are so concerned about their woofers and tweeters" may well despise equipment assembled on such a nondescript basis.

There's just a chance that their assessment of performance may be a trifle more — er, mature — than that of our correspondent. To extend his simile, they may be somewhat concerned about the state of the said trees in the forest!

So much, then, for audio problems.

It is bad enough having to anticipate arguments relative to material which is currently being prepared. It is much worse when things written by any member of the staff are likely to be resurrected and questioned by an assiduous reader, years later. That is exactly what has happened in the letter quoted here under the heading "Error In Our Meter Article?"

I suggest that you read the letter, now, so that you'll know what this is all about.

Briefly and to reiterate, the article in question dealt with the construction of what we were then pleased to call the "R. and H. Junior Multimeter." The writer, Philip Watson, discussed the type of meter movement required, mentioning both deflection sensitivity and internal resistance.

TRIAL AND ERROR

It was pointed out that home-made shunts could be adjusted by trial and error for any meter but that ready-made shunts would normally only be correct for meters having an internal resistance of 100 ohms, or which had been provided with a series resistor to bring them up to this effective value.

This led into a warning against trying to measure meter resistance by ordinary methods and the observation about shunting the meter, as quoted by A.D.F.

In actual fact, the line of argument advanced by A.D.F. is quite valid, the only catch being that he has overlooked the significance of one very vital word.

If the text had said "until the meter READING is reduced by half," it would definitely have been wrong and we would have had to chalk up a fall to A.D.F. But the text didn't say that; it said "until the meter SENSITIVITY is reduced by half," and that is a very different matter.

It assumes that there is something in circuit by which the SENSITIVITY of the meter can be checked, which would have to be another meter. Thus the shunt across the meter under test would be adjusted until it indicated half the reading of the reference instrument. The exact figures would not matter, provided the 2:1 relationship was obtained.

Alternatively, circuit conditions would have to be assumed wherein the reading of the meter would relate closely to any change in sensitivity and this would only obtain where a high voltage source was used.

Mr Watson was quick to make these points when faced with his alleged "misdemeanour" and to point out that he had no desire, in writing the original article, to be side-tracked into a discussion of measuring meter resistance. Hence the passing reference and the deliberate choice of the right word.

HAS A POINT

But A.D.F. probably has a point, notwithstanding. If the choice of a word was lost on one, who obviously has the capacity to work things out for himself, it is not likely to register with those having less knowledge of the subject to begin with.

So perhaps both parties can retire from the fray with honour unsullied but the point has been clarified and that is what really counts.

To change the subject, yet again, I have to acknowledge rather belatedly, a letter from a reader in Hyde Park, S.A. He has something to add to earlier discussion in these columns (and by The Serviceman) as to whether the physical position of an object causing a television "ghost" can be deduced from the position of the ghost on the screen.

You may recall that several readers suggested that it could, by relating observations of one station on different receivers, or on the one receiver of stations which were physically separated. By deducing the added length of the "ghost" path and drawing suitable ellipses on a map, the point of intersection would allegedly be the location of the ghost-producing object.

SOURCES OF ERROR

While this sounded like a nice piece of theory, I think we were able to demonstrate that there were so many possible sources of error and confusion that the idea had little practical value.

A.L. is apparently not satisfied, however. He writes as follows: "The rough method suggested by the Serviceman (October, '59) for measuring the displacement on the picture tube contains too many variables, e.g. the active horizontal scanning period, setting of width control and horizontal linearity of the receiver.

"The following method is independent of these factors:

"(1) For calibration purposes, the transmitter would put up a marker pattern of vertical bars. A black grid would do quite well. The time interval between the bars can easily and accurately be measured at the transmitter. (The patters I have in mind displays 17 vertical bars

(Continued on Page 123)

ERROR IN OUR METER ARTICLE?

Dear Sir,

I have a meter and I know the full-scale current but I do not know its internal resistance.

Of course, I had enough sense not to try to measure the internal resistance on a Wheatstone Bridge, so I looked up some of the literature and came across what seemed to be the answer in the September 1954 copy of your magazine. (Page 29, centre of column 1.)

To quote: "One method of finding the internal resistance of a meter is to shunt it with a variable resistance and adjust it until the meter sensitivity is reduced by half. This external resistance will now equal the meter resistance."

There seemed to be something wrong with this statement, so I did a bit of calculating. Now I will stick my neck out and say that the statement is a little misleading and is wrong unless qualified by saying that the supply voltage used must be as high as possible.

As the paragraph dealt with making a simple multimeter, no doubt some of the less experienced readers might have decided to use a 1.5 volt torch cell as a source of voltage for the test.

In this case, if the shunt resistance is taken to equal the meter resistance, there will be an error of 6.7 pc. and a consequent error in the calculated value for the meter shunts.

The two graphs I have enclosed tell the story. (These graphs and the relevant discussion have not been reproduced herewith. Ed.)

It is assumed, of course, that the source of voltage has no impedance.

Assume a meter with an internal resistance of 100 ohms and a full scale deflection sensitivity of 1.0 milliamp.

Two interesting cases for this particular meter arise when the testing voltage is exactly 0.1 volts and, again, when the voltage is slightly higher than 0.1 volts.

When the test voltage is exactly 0.1 volts, then, no matter how low the variable shunt is made, the meter will always read full scale and will function merely as a voltmeter.

If we assume that the test voltage is increased by dE (as the mathematicians say), and work the example out, we find that the variable shunt will have a very low resistance and be carrying a very high current to get the meter midscale.

If the test voltage is 0.1000001 volts, the variable shunt will have a value of .0001 ohm and will be carrying 500.005 amperes.

Again, if the test voltage is exactly 0.1 volts, then the shunt value would be zero and the current through the shunt would be infinite. This, of course, would be quite impossible in a practical case.

Your faithfully,
A.D.F.

PHASING SPEAKERS FOR STEREO

Should stereo loudspeakers be phased? What happens if they are not? How does one tell when they are phased? These questions are recurring regularly in our technical mail. This article may contain some of the answers you have been seeking.

by Neville Williams

IN this context, phasing refers to the relative movement of two (or more) speaker cones reproducing, in whole or in part, the same sound signal.

If the speakers are in phase, the common signal will cause the cones to move outwards from the housing together and inwards together. Assuming normal mounting methods, they will therefore have an additive effect on the air in the listening room, both tending to produce compression at the same instant, then the reverse.

Cone phasing depends on the signal fed to the speaker, the actual connections to the voice coil and the polarity of the magnetic field.

Phasing problems are not peculiar to stereo and, in fact, arise whenever two or more speakers, mounted in proximity, have to serve a common listening area.

For example, many conventional mono radiograms have used two or more parallel-connected speakers, either for technical reasons or as a sales gimmick. Such speakers must be correctly phased.

When operating in phase, normal reproduction is obtained. If connected out of phase, there is a severe diminution of low frequency response and the overall reproduction becomes very "thin" as a result.

The reason for this is that air compressed by one cone, as it moves forward, flows into the partial vacuum created by the second cone, moving backwards. Thus, at low frequencies particularly, air is simply pumped back and forth between the two speaker openings, without having a chance to create a wavefront, which will radiate into the main body of the listening room.

This, for two speakers connected directly in parallel.

Phase relationships are much less obvious in multiple speakers operating from a cross-over network, for two reasons: (1) The frequency range over which the speakers overlap is relatively narrow and (2) It occurs in the middle or upper register where the time taken for waves to travel between cone surfaces may approach or exceed the period of one audio half-cycle. Simple cancellation, as described, cannot therefore take place.

Low and middle frequency speakers used in a mono system can usually be phased beforehand by energising their common line with a battery, as for example, a single torch cell. If the speakers are correctly phased, their cones will move in the same direction when the battery voltage is applied to the line.

"TWEETER" SPEAKERS

This test may be impractical with high frequency "tweeters" because of their very restricted cone movement and the fact that they would normally be fed through a capacitor which would block a DC shift, as part of its function.

In any case, phase would appear to be uncritical in tweeters mounted separately from the bass and middle speakers. With coaxial tweeters it could be more important but one would expect the manufacturers, in such a case, to have secured the correct phase relationship, either by prior connection of the tweeter or by specifying the method of connection.

At first glance, the phasing of stereo speakers would appear to be complicated by the fact that they are carrying different signal information.

This is only partially true, however, because portion of the two signals, particularly at the bass end, will be symmetrical and in phase. And, of course, a stereo system may equally well be used for mono, in which case the signals in both channels will be identical.

Another major consideration is that stereo speakers are normally separated by as great a distance as circumstances will allow and, as far as the listener is concerned, this reduces but does not eliminate signal cancellation by what we might call "inter-cone pumping."

Consider two extreme cases:

TWO EXTREMES

In a simple stereo radiogram, the speakers may be separated only by two or three feet and the bass component, which will normally be in phase in the two channels, could either add or cancel, much as in an ordinary multiple speaker mono radiogram.

Therefore, it should be possible to judge correct phase by simply listening for best bass response. To minimise any risk of error, the test should be done with a mono record or with the equipment switched to mono, so that both speakers will have identical signals.

The other extreme is with the stereo speakers widely separated, in which case it becomes rather difficult to pick correct phasing by direct listening, particularly in an ordinary room.

Main reason for this is that each speaker has the opportunity of initiating a separate pattern of radiation and reflection within the listening room so complex that large-scale cancellation is unlikely.

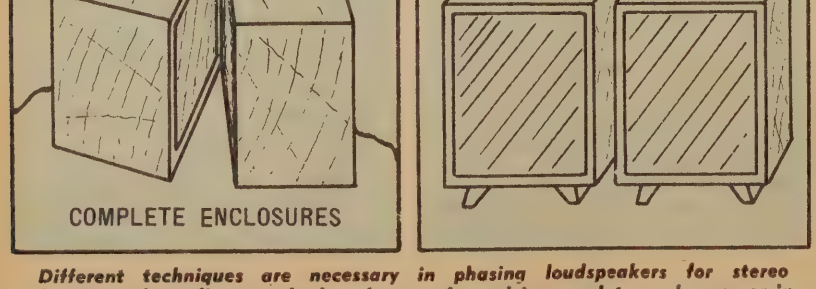
Therefore, the idea of listening to music, pausing to reconnect one set of speaker leads and then listening again, is likely to yield the conclusion that phasing makes no difference in such circumstances.

LESS CRITICAL?

And it certainly supports the argument that phasing is not nearly so critical as with speakers mounted more closely together.

If the amplifier has a reversing switch on one voice coil channel, as suggested for a couple of our later designs, instantaneous switching will often show up a slight difference and the "in-phase" connection is usually distinguished by slight extra "body" in the overall reproduction. More technically, this would imply less cancellation of low frequency energy and better development of wavefronts in the room.

It may be argued that "in phase" relationships should be obtained automatically by observing symmetry in the overall connections between pickup, ampli



Different techniques are necessary in phasing loudspeakers for stereo listening, depending on whether they are housed in complete enclosures or in open-backed cabinets.

fiers and speakers. This is not necessarily so, however.

Loud-speaker manufacturers have not always observed standards in magnet or voice coil polarity and only recently have some of them adopted procedures to ensure such uniformity. And even if speaker polarity is verified by the aforementioned check with a torch cell, there remains the possibility of wrongly phased output from the pickup cartridge itself. Or yet again, the amplifiers may be dissimilar.

SIMPLE TEST

A very simple means of checking phase exists for loud-speaker pairs, which are housed in any form of cabinet having low radiation from the rear. This applies to so-called "infinite" baffles, vented enclosures, R-J enclosures, folded horns and "boffles."

Set the balance control to give approximately equal volume from the two speakers. Then stand the cabinets face to face, with one edge touching and the other separated to form a shallow "V," facing into the listening-room. Play a mono record or switch to "mono" and listen to the result.

With the speakers in phase, both cones will move towards one another or away simultaneously, compressing the air or rarefying in the "V" space between the cabinets. A slightly "woofy" but otherwise substantial output will be radiated into the listening-room. Shorting either channel will reduce the volume.

This is the correct condition.

If the speakers are out of phase, they will tend simply to push the air back and forth between them with very little energy being radiated into the listening-room. Adjusting the balance control can produce almost complete cancellation, but shorting either speaker will increase volume.

This is the incorrect condition for stereo listening. Reverse the connections to one voice coil, not both.

With open-backed cabinets or unmounted speakers, the situation tends to reverse and the incorrect or out-of-phase connection tends to produce the greatest sound output. The reason is simply that the speaker cones then aid one another to radiate from the respective rear surfaces.

Where there is substantial back radiation, therefore, the test becomes inconclusive.

In this case, the best plan is to stand the two speaker cabinets side by side and as close together as possible, facing into the listening-room. If at all possible, wire in a double-pole double throw switch to change the polarity of one speaker.

Select the position which gives the best middle and low frequency response.

And so, to sum up, let's restate the original questions and their answers in brief:

Q.: Should stereo loud-speakers be phased?

A.: Yes, they should. If, additionally, multiple speakers are used for each channel, they should be phased together as per mono practice, then one group phased in relation to the other.

Q.: What happens if they are not?

A.: If the stereo speakers are close together, there will be an obvious loss of bass in the listening position. As the distance is increased, incorrect phasing becomes more difficult to observe, particularly in a small listening-room, but critical listening will usually reveal the advantage of correct phasing.

Q.: How does one tell when they are phased?

A.: With closed back cabinets, stand them face to face and test as described earlier. With open-backed speakers, stand them side by side and phase for maximum bass.

SACRED RECORDS FOR THE MONTH

SEVEN LAST WORDS (Theodore Dubois), presented by the Oratorio Singers, with pipe organ, harp and tympani, conducted by Clarence Snyder. Mono, GFM 24-W4002-LP.

This cantata is based on the recorded utterings of Christ on the Cross, beginning with "Father, forgive them . . ." and culminating in "It is finished."

Each is quoted by a soloist, then expanded in traditional cantata fashion, with repetition and companion quotations. In many ways, the cantata is comparable with "The Crucifixion," mentioned recently in these columns, but is less episodic.

When the record came to hand, I recalled a previous release of the same work on a Cook label (LP 1094) which was noteworthy, amongst other things, for some 16-cycle organ notes recorded thereon. Inquiries revealed that the disc was still available and I obtained a copy for comparison purposes.

In point of fact, the two discs provide, rather, a study in contrasts.

The Cook disc was recorded in the Symphony Hall, Boston, with the Boston Chorale and with Reginald Foort at the organ.

Musically, I rate it as the better performance. The acoustics of the hall and the microphone placement provide just the right amount of reverberation for good atmosphere. The soloists emerge just enough to be distinctive, but are never divorced from the choir.

And Reginald Foort gives a notable performance at the organ, a magnificent instrument with two ranks of 32-foot pipes.

The words are in Latin throughout, simple and dignified. Printed on the jacket, I had no great difficulty in following and translating them.

Against all this, the GFM record is aimed for more popular consumption, with words in English and using a close-microphone technique such that one would need to be stone deaf to miss a single syllable. But the voices acquire the same hard, metallic quality, in the process, for which I criticised the "Crucifixion" on the same label.

The harp and tympani are written neatly into the score but are justified only because the organ is not nearly as adequate as in the Cook recording.

Technically, neither disc is above reproach. The Cook disc has great potential but doesn't quite live up to it. There is a recording "blue" during the fifth word that should never have got on to disc. On the same side there is a tendency for loud choral passages to break up, at least with an 0.7 mil. stylus.

In the GFM disc there are faults of another kind. The noise level on side 1 is higher than it should be and the silence between tracks is noticeable by contrast. One organ solo is punctuated by noises from (presumably) the swell shutters, so loud that one might be forgiven for assuming that a couple of choir members had to leave early!

Against this, side 2 is much quieter and more cohesive, such that it suggests a completely different recording session.

In the aggregate, however, if you liked the GFM version of "The Crucifixion," then you'll probably appreciate also their "Seven Last Words." In many ways it is a companion disc.

★ ★ ★

"HYMNS THAT LIVE," played on the Wurlitzer organ by George Wright. Hifirecord, Stereo, NOR 714.

Stated purpose of George Wright in this record is to demonstrate that many of the traditional hymns have more charm and substance than the current crop of "commercially devised" religious songs.

And, listening to it, I gathered the impression that George Wright thoroughly enjoyed making the record. Though, in characteristic fashion, he provides a constant interplay of organ voices, the changes are effected smoothly and made to emphasise the mood of the lyric.

The tempo generally is unhurried, as if the organist has all the time in the world to work out his arrangements. Only in "Onward Christian Soldiers" and "A Mighty Fortress" is a militant atmosphere created and Wright's adeptness at the keyboard is well demonstrated on these tracks.

The recording is adequate without being outstanding in terms of definition, and a few noise spots were apparent on one side of the disc.

The hymns included are "Ivory Palaces," "The Old Rugged Cross," "Evening Hymn," "Rock of Ages," "Sweet Hour of Prayer," "Nearer My God to Thee," "A Mighty Fortress," "I Would be True," "Beautiful Isle of Prayer," "I Love to Tell the Story," "Abide With Me," "Softly and Tenderly," "In the Garden," "Onward Christian Soldiers."

★ ★ ★

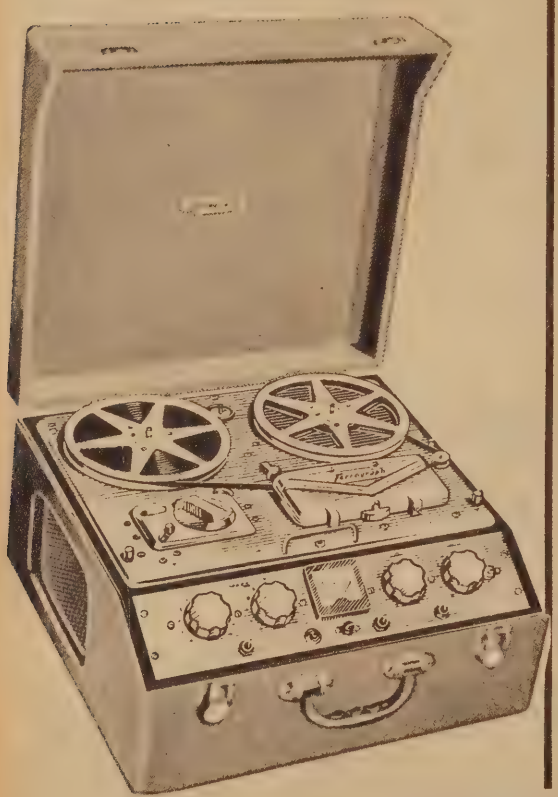
"ABIDE WITH ME," played by the Cathedral Strings, directed by Michael Collins. Columbia, stereo SCX-03261.

This presentation of 12 well-known hymns is unusual, in that a string orchestra is employed, with occasional appearance of organ, drums and other instruments.

Musically the result has variety and impact and the tempo is maintained strictly to allow it to be used as an accompaniment for congregational singing. With this same thought in mind, the words of the hymns are printed on the cover and could readily be re-photographed as slides.

The hymns are as follows: "The King of Love," "Eternal Father," "All Things Bright," "Rock of Ages," "We Plough the Fields," "Oh God Our Help," "The

8 IMPORTANT DESIGN IMPROVEMENTS IN NEW FERROGRAPH SERIES 4



This latest development of the incomparable Ferrograph incorporates several new design improvements and will enable every Series 4 Ferrograph to be readily adapted at any future time for a variety of applications. For example, space has been provided under the Head Cover to permit Head changes and additions for monitoring, stereo playback and for lower track uses. Such heads are designed to be plugged in and are fitted with rocking facilities for azimuth correction.

Also, this new development permits any Series 4A to be instantly converted to a Series 4S merely by plugging in the additional stereo head.

Other important design improvements are:

- The capstan motor is resiliently mounted for quiet operation.
- Function Switch Knob is re-fashioned for greater ease of operation.
- Brief Stop is now a standard fitting on all Ferrographs.
- The Head Cover—a one-piece moulding—is hinged for easy tape loading.
- The Turns Counter—now gear driven—is accurate to a turn.
- New standard colour scheme for all models—2-tone grey.

SERIES 4A
With standard monaural recording/playback facilities.
Model 4A/N 3¾/7½ i.p.s.
Price £239 2 6
Model 4A/H 7½/15 i.p.s.
Price £271 12 6

SERIES 4S
With optional stereo sound playback facilities in addition (when used with Stere-Ad Unit).
Model 4S/N 3¾/7½ i.p.s.
Price £268 0 9
Model 4S/H 7½/15 i.p.s.
Price £289 1 0
Stere-Ad Unit (when required) £90 9 0

SERIES 88
With full stereophonic recording and playback facilities.
Model 88 7½/15 i.p.s.
Price £302 7 6

PRICES QUOTED ARE RETAIL. TRADE PRICES EXTENDED TO BROADCASTING INTERESTS.

THE INCOMPARABLE **Ferrograph**

Demonstrations and supplies available from: **TAPE RECORDERS PTY. LTD.**
60 Clarence Street, Sydney. BX 1571

PLEASE WRITE TO US FOR FULL DESCRIPTIVE LITERATURE AND NAME OF YOUR NEAREST DISTRIBUTOR AND SERVICE AGENT

Day Thou Gavest," "Praise My Soul," "Love Divine," "There is a Green Hill," "Lead Us Heavenly Father," "I Heard the Voice," "Abide With Me."

Unfortunately, on this occasion, the presentation has been let down by the recording. The violins have an "edge" of distortion, while the stereo has only limited effect. True, the distortion yields to treble cut but such a step should not be necessary.

It looks like a case for a better pressing.

★ ★ ★

SLIM WHITMAN, "I'll Walk With God." Mono, London, HAA7570.

This record will have its greatest appeal, I imagine, to church youth groups or to teenagers whose interest turns to hymns.

Slim Whitman is billed as a "Western" singer but the adjective is more of a suggestion than a description, as far as this record is concerned.

To be sure Whitman has a smooth tenor voice, which breaks easily enough, Western style, but he uses the effect only rarely in this record.

And his backing, while it also carries a hint of Western style, is a really quite urban combination of organ, electric guitar, bass, chimes and chorus. The result is tuneful and relatively modest with Whitman managing to convey a good deal of sincerity. I doubt that the style will be modest enough for conservative listeners, however.

The hymns featured are: "I'll Walk with God," "Whispering Hope," "I'm a Pilgrim," "An Evening Prayer," "Jesus Took My Burden," "Sunrise," "Walk Beside Me," "Each Step I take," "The Great Judgment Morning," "He Lives on High," "Today Is Mine," "When I Go To My Garden."

Technically the record is first class. The balance is good, quality clean and completely free of background noise.

VARIED MOOD

"BACH ON THE BIGGEST." Played by Robert Elmore on the Atlantic City Convention Hall Organ. Mercury, Mono MG50127.

The title of this disc sums up its contents quite accurately. It is an organ spectacular, a kind of acoustic "documentary" which will appeal most to devotees of the organ, in the "mechanical" sense of the term.

Claimed as the largest in the world, the Atlantic City Convention Hall organ involves 5 manuals, 232 stops, 18,000 pipes and a variety of other statistics listed on the jacket.

It is also housed in a building which seems to have a reverberation period of around five seconds and what this does to the music can well be imagined. On the louder, more complex passages, each successive note appears briefly before falling back into a veritable sea of sound.

Through it all, the organist forges ahead, seemingly regardless, determined to demonstrate his complete ability to manipulate the monster.

The power in the bass register is tremendous.

The wonder of it is that the recording engineers have managed to channel all this into a record which does play cleanly on good equipment. On anything less, I imagine that the whole would coagulate into a hopeless mess, by reason of the acoustic complexity.

In the quieter sections, some background noise is apparent but this seems to be a common failing with many organ records. Elsewhere, background noise doesn't stand a chance.

The contents are: Toccata and Fugue in D Minor — Wachet Auf! — In Dulci Jubilo — Toccata, Adagio and Fugue in C.

★ ★ ★

WILBUR KENTWELL "Smoke Gets In Your Eyes." Columbia, Mono, 330SX7621.

This is another well-recorded disc by Wilbur Kentwell using the double recording technique, to produce piano and Hammond organ duets.

Cyril Bevan backs the combination with drums.

The subject matter in this case is the music of Jerome Kern and the 12 tracks between them provide a medley of 49 well-known melodies, woven into a rhythmic and ever-changing pattern.

Kentwell does this sort of thing extremely well and the whole setup is a natural for "separative" stereo treatment.

What about it, then?

The present recording, an entirely local effort is just about flawless, with good balance, not a trace of distortion, and completely free of background noise.

★ ★ ★

MAURICE CHEVALIER, "Life Is Just a Bowl of Cherries." Mono, M-G-M — 02 7555.

In characteristic fashion, Maurice Chevalier intones his way through a dozen old favourites — "Life Is Just a Bowl of Cherries," "You Must Have Been a Beautiful Baby," "Did You Ever See a Dream Walking," "She Didn't Say Yes" and so on.

There's nothing very melodious about the singing — there never was — but the Chevalier personality shows through — the personality which has kept him at the top of the ladder for a very long time.

In any case, the backing orchestra under Ray Ellis provides just the right kind of melodic backdrop for the Chevalier vocalising.

And the recording itself is excellent. You get Chevalier close to mic., the orchestra nicely in the background, no distortion and no noise.

★ ★ ★

"INSIDE SHELLEY BERMAN," Humorous monologue. Mono, Verve, MGV-15003.

"OUTSIDE SHELLEY BERMAN." Humorous Monologue. Mono Verve MGV-15007.

It is a great help, in listening to a humorous recording, if one can arrange beforehand to be a fan of the particular artist.

I must confess that, personally, I had to refer to the jackets to fill in the details of Shelley Berman as under:—

His approach is patter without props; his specialty is presenting one side of an imaginary telephone conversation; he is much sought as a nightclub entertainer; he has been featured in some of the nation's big television shows.

To this I must add that he is possessed of a clear voice, smooth presentation—and a recording engineer who knows how to capture Berman's voice against the background of an actual nightclub audience without sacrificing either.

To a stranger, Berman's impact is not immediate but, by the time I had played through "Inside Shelley Berman," I was more ready to appreciate the contents of the second record. Maybe that's why I liked it the better of the two.

In this one Berman assumes the role of a Jewish father being "touched" by his son for a hundred dollars. He burlesques a theatrical booking agent, the telephone information service and finally plays a question-and-answer game with the audience.

His attitude is slightly irreverent, slightly broad but always good humoured.

If you want Shelley Berman, these records will bring him to you very effectively.

★ ★ ★

PAT AND SHIRLEY BOONE, "Side by Side." London, Mono HAA7544.

Though Shirley Boone has had previous experience as a singer, she teams with her husband for the first time in this disc.

Having devised a suitable duet formula and backed by Mort Lindsey and his orchestra, Pat and Shirley proceed to sing their way through a dozen old-time love ditties, such as "Let Me Call You Sweetheart," "Melody of Love," "You Can't Be True Dear," "Now is the Hour," "Let the Rest of the World Go By."

What with these numbers and the homey little patter on the jacket, I almost felt like an intruder as I listened. But the teenagers present had no such inhibitions nor, I imagine, will Boone fans.

After all, Pat sings smoothly on, in his characteristic style; Shirley blends in cosily and the orchestral accompaniment is nicely balanced.

The sound is clean and the surface silent. What more could one ask for?

★ ★ ★

"THE GATHERING OF THE CLANS," Pipers of the 1st Batt. Scots Guards; Pipes and Drums of 2nd Batt. Scots Guards. Parlophone EP45, mono, GEPO 8761.

Not being a Scot, either by birth or adoption, it would be presumptuous of me to suggest the likely effect of the contents of this record on those who are. It seems to be an attempt, by means of the fader, to create the effect of a march past of the Clans — The Camerons, the McPhersons, the McGregors and so on.

Unfortunately those responsible seem to have been a wee bit canny about the recording gear and the frequency response is limited enough to rob the sound of much of its potential impact.

But then, as I said, I'm not a Scot.

A new meaning for excellence

STEREOPHONIC HIGH FIDELITY

By harman kardon U.S.A.

Now available in Australia

"The Stereo FESTIVAL" Model TA230

The new stereo Festival represents the successful crystallisation of all Stereo know-how in a single superb instrument.

Picture a complete Stereo Electronic centre: dual amplifiers (15 watts each) with input facility and control for every stereo function including the awaited FM Multiplex service.

Separate sensitive AM and FM tuners.

Features include:— H-K friction clutch tone controls to adjust Bass and Treble separately for each channel. Speaker phasing switch; silicone diode power supply; grain oriented cores in output transformers result in wide frequency response and unexcelled transient response.

Separate electronic tuning bars for AM and FM; automatic frequency control, contour selector, rumble filter, scratch filter, mode switch, record-tape equalisation switch and illuminated push-button on/off switch. Two high gain magnetic inputs for each channel.

"The Stereo Festival," Model TA230, **illustrated, £291/-/-** tax included. Finish — Copper and black.

Other models available include:—

"The Ballad" Model A230 similar to the Stereo Festival but does not include the AM/FM tuning section. Features the "THIRD CHANNEL SPEAKER SELECTOR SWITCH." Finish — Copper and grey. **Price £126/-/-.**

"The Lute" Model A220. A remarkable new amplifier which brings Stereo High Fidelity within the reach of everyone. Incorporates dual Stereo pre-amps and two 10-watt amplifiers, magnetic inputs. For those who want quality as well as economy "The Lute" is the ideal instrument. Finish — Copper and black. **Price £95/-/-.**

"The Sonnet" Model T230. Stereo AM/FM Tuner. Similar to tuning section of the "Stereo Festival." May be used with any amplifier available. Self-powered. Finish — Copper and grey. **Price £128/-/-.**

harman kardon

DISTRIBUTED IN AUSTRALIA BY

Fidelity AE **Audio Engineers PTY. LTD.**

"THE SENTIMENTAL BLOKE" (C. J. Dennis), read by Gordon McDougall. Bri-Tone, mono, BT62-200.

Written by C. J. Dennis, "The Sentimental Bloke" is well known in Australian literature. The book contains the biographical musings of a rough but lovable character who begins life, around the turn of the century, in the poorer environs of Melbourne.

His mood at the outset is melancholy . . ."The world 'as got me snouted." Things take a turn for the better when he meets Doreen, who returns his interest. They see a Shakespearean play together, which the Sentimental Bloke describes in his own inimitable way. Then a rival shows up in the person of "The stror 'at coot," but he is successfully dealt with.

In due course, the Sentimental Bloke has to meet "Mar," then listen to a sermon from the "Pilot Cove."

He describes the wedding ceremony "Hitched," his feelings when he comes home drunk at the instigation of an old pal, "Ginger Mick." He tells of Uncle Jim, who gives them a start on a farm, the birth of "the Kid," then rounds it all off with a soliloquy, "the Mooch Of Life."

The Sentimental Bloke is a deeply human and very Australian character whose biography, in book form, has sold just under 200,000 copies. He has fans in all walks of life.

The complete book has now been transcribed to a 12in microgroove disc, playing at 16 2/3 r.p.m. At this slow speed, one side gives 40 minutes of playing time and the other 42½ minutes.

The disc is cut with a standard small groove and can be played with an ordinary 1-mil microgroove stylus or the somewhat finer stereo stylus. But, of course, the player must be capable of operating at 16 2/3 r.p.m.

The recording quality throughout is excellent, with low noise and plenty of sibilants, thanks probably to liberal treble boosting.

The voice belongs to Gordon McDougall and herein lies my chief point of criticism about the record. Though McDougall reads clearly and with feeling, his accent belongs unmistakably to the regions between London and Edinburgh. He can recite the story, but never assume the role of the Sentimental Bloke.

But having made the necessary adjustment during the first couple of poems—the least memorable ones—I found myself chuckling all over again at "The Play" and the contents of side 2. You'll probably do the same.

Another small point is that the publisher's name is announced at the end of side 2. Though it is only a minor detail, the record would be better without this quite unnecessary heritage of a past era.

"The Sentimental Bloke" is available, at the moment, only through the publisher, Bri-Tone Records, Box 16, Post-Office, Brighton, South Australia. The price is 57/6, postage and packaging free.

It comes, by the way, in a book-type folder containing story synopsis, details of C. J. Dennis and Gordon McDougall, illustrations by the original Sentimental Bloke artist, Hal Gye, and a glossary of terms for those whose knowledge of Australianese needs to be supplemented.

IN REVIEW — By JULIAN RUSSELL

TWO VERSIONS OF "THE MESSIAH"

Handel — The Messiah. Performed by Elsie Morison, Marjorie Thomas, Richard Lewis, and James Milligan with the Huddersfield Choral Society and the Royal Liverpool Philharmonic Orchestra conducted by Sir Malcolm Sargent. Columbia Mono 330CX 1668/70.

This is an "orthodox" Messiah, the presentation of which has not benefitted by the Handelian scholarship acquired during the last two generations. It is a Mozart-Prout-Sargent edition differing little from the mid-Victorian version that crops up every Christmas all over the English-speaking world.

The orchestration therefore is not Handel's and such eighteenth century stylistic characteristics as free ornamentation have been ignored. Still, in the form presented here it will no doubt be more familiar to its regular Christmas audiences than any more recent reconstruction which aims at reproducing the composer's original intentions.

The set differs little from the one recorded by Sargent some five years ago for Columbia. The soloists are the same with the exception of James Milligan, who replaces Norman Walker. Milligan's range and breath control are an improvement on those of his predecessor's.

Repetition seems to have staled slightly the original freshness of Elsie Morison's reading, but Richard Lewis is as excellent as ever. Marjorie Thomas' performance suggests, as previously, a "sound oratorio woman."

The Huddersfield is again splendidly drilled and responsive to Sargent's authoritative direction. An eminently worthy, if not exciting set.

★ ★ ★

Handel — The Messiah. Performed by Eileen Farrell, Martha Lipton, Davis Cunningham and William Warfield with the Mormon Tabernacle Choir and the Philadelphia Orchestra conducted by Eugene Ormandy. Coronet Stereo KLCS 2707/8.

The sound is much more opulent here than in the Columbia noticed above and the stereo treatment gives it added breadth and better definition in the antiphonal portions of the score. But this, too, is a "traditional" (Victorian) edition owing much to Prout, and slightly more abbreviated than Sargent's.

Like the Sargent version it will contain no surprises for the usual Christmas audiences who nowadays seem to favour size in place of subtlety. Eileen Farrell excepted, the soloists are not as satisfactory as in the English performance. But Miss Farrell, both vocally and interpretatively, is outstanding. She is at once reverent and lyrical and her superb breathing adds magnificent breadth to her phrasing.

A slight unsteadiness of tone sometimes mars the performances of the other three soloists, but Warfield makes some spectacular changes of colour throughout his reading. The choir is a very large one of 375 voices drilled into first rate precision of attack and release though not quite so expressive as the Huddersfield.

Some of Ormandy's tempos, like Sargent's, are a bit on the slow side but his generalship over the deployment of his very large forces is never in doubt. His reading is much more conventional than Leonard Bernstein's whose Messiah was put out by Coronet last year.

★ ★ ★

Liszt — Piano Concerto No. 1 in E Flat Major. Piano Concerto No. 2 in A Major. Played by Philippe Entremont and the Philadelphia Orchestra conducted by Eugene Ormandy. Coronet Stereo KLCS2702. Mono KLC 2702.

My mono pressing was cleaner than the stereo which was a little sandy in the quiet passages. But otherwise the good sound on the mono was even better on two-channel engineering. It would have been still further improved had the solo piano, in the stereo pressing, been anchored more firmly between the two speakers. I found its tendency to move from right to left and back again a little distracting.

But no technical considerations could dim my enjoyment of Entremont's delightful playing. In the E Flat some oddly placed accents right at the beginning momentarily threaten eccentricity. But there is no hint of anything untoward happening later on.

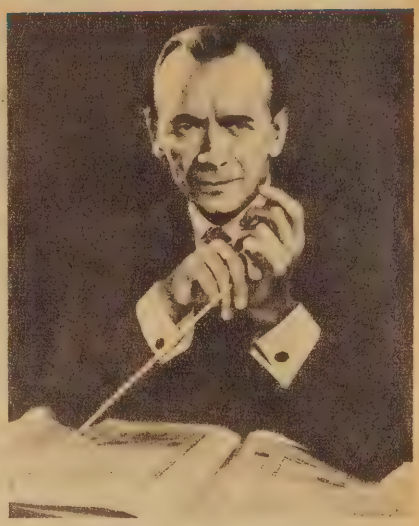
Entremont's technique is formidable, his phrasing fastidious, and his whole performance pervaded by well-disciplined ardour. The freshness of his exuberant treatment is consistently delightful in both concertos and the support given him by Ormandy and his orchestra must have been inspiring indeed during the recording session.

The piano tone throughout both works is a trifle light though this, of course, adds brilliance to the treble even if it sometimes deprives the middle register and bass of a full measure of resonance.

★ ★ ★

Liszt — Piano Concerto No. 1 in E Flat Major. Chopin — Piano Concerto No. 1 in E Minor. Played by Samson Francois and the Orchestre de la Societe des Concerts du Conservatoire, conducted by Georges Tzipine. Variety Club Mono 330 EX 7511.

Like Entremont, Francois is French, but that seems to be the only thing the two have in common — at least musically. Francois' performance of the Liszt is lax to the point of slovenliness. He has scant respect for the composer's score, lengthening notes here and shortening them there.



Sir Malcolm Sargent

In the slow section, however, he temporarily becomes more poetic and observant of the composer's intentions, but the mood doesn't last long. The balance between soloist and orchestra is seldom satisfactory and the engineering, compared to Coronet's mono version, is extremely pinched in the quality of its sound.

Nor did I find him any more pleasing in the Chopin on which he inflicts the same ill-treatment. Here again he frequently converts crotchets into quavers and vice versa. Moreover in this concerto he is encouraged by an accompaniment that is equally delinquent.

★ ★ ★

A Chopin Recital — Sonata in B Flat Minor, Op. 35; Nocturne in F Minor, Op. 15, No. 1; Etudes in F Minor, Op. 25, No. 2 and C Minor, Op. 10, No. 12; Waltzes in E Flat Major, Op. 70, No. 3 and C Sharp Minor, Op. 64, No. 2; Polonaise Brilliante. Played by Samson Francois. Variety Club Mono 330 EX 7510.

Francois is again peccant in this recital. The staccato in the F Minor Nocturne is ludicrous and the Polonaise is all over the place rhythmically. His playing of the C Sharp Minor Etude is full of undisciplined violence. The Sonata features many beautiful passages ruined by the juxtaposition of carelessly, or eccentrically phrased, contexts. The sound is no better than adequate.

★ ★ ★

Russian Music played by the Philharmonia Orchestra conducted by Charles Mackerras. Overture to Russlan and Ludmila (Glinka), Gopak from Sorotchinski Fair (Moussorgsky), Concert Waltz No. 1, Op. 47 (Glazounov), Dance of the Tumblers from The Snow Maiden

Dual

STEREO

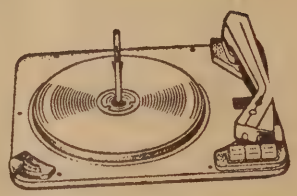
PRECISION-BUILT CHANGERS and PLAYERS

Dual 1006 STEREO CHANGER

The manifold functions and superior reproduction of this model will surprise every Hi-Fi enthusiast. For operation as a changer, automatic player and two methods of studio style manual operation.

FEATURES. Push button operation—stereo key—manual key—built in weight scale and regulator—rumble free 4-pole motor—11in dia. Hi-Fi turntable — interchangeable cartridge holder to suit all cartridges with standard fitting —supplied fitted with DUAL CDS 420 cartridge for Stereo and LP records.

1006



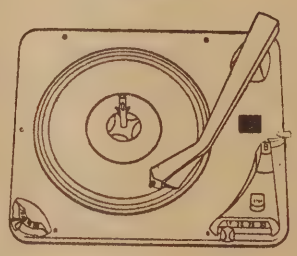
£39/12/-

Dual 1007 STEREO CHANGER

Modern styling, exceptional sound reproduction, universal operation either as a fully automatic changer, fully automatic or manual single player for all record sizes, simple and sturdy construction securing the utmost in reliability are the outstanding features of the DUAL 1007.

FEATURES. Push button operation, start, stop and repeat —four speeds—tonearm lock—self stabilising change spindle—outstanding high fidelity reproduction through the DUAL Piezo-electric pickup system CDS 520—Stylus pressure 5/6 grms.

1007



£26/15/-

Dual 1004S STEREO CHANGER

Outstanding in sound quality, versatile in application, automatic indexing of record sizes and extreme comfort of operation are the most agreeable features of the DUAL 1004S.

FEATURES. Push button control, start, stop and repeat— stereo key—pickup arm lock—fitted with Dual stereo cartridge CDS 320—stylus pressure 5/6 grms.

1004S

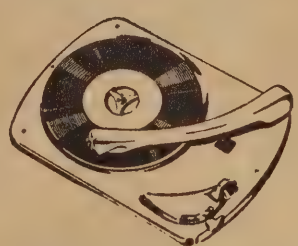
£37/9/6

Dual 300 STEREO PLAYER

Outstanding quality of reproduction both stereo and monaural records, sturdy construction and modern styling are the dominating feaures of this record player.

FEATURES. Four speeds—pickup arm lock—turntable brake. Available fitted with CDS 320/3 stereo cartridge or for monaural application the CDS 310/3 cartridge.

300



With Stereo Cart. £21/5/-
With Mono Cart. £18/16/3

WRITE FOR DETAILS

FRED A. FALK & CO. PTY. LTD.

28 KING STREET, ROCKDALE. Phone LX4783.

Distributed by: N.S.W. and Victoria—all leading electrical houses. QUEENSLAND—Ron Jones Pty. Ltd., 1-5 Merton Road, South Brisbane. S.A.— L. S. Wise Ltd., 196 Gilles Street, Adelaide. W.A.—Athol M. Hill, 842 Hay Street, Perth.

(Rimsky-Korsakoff), Flight of the Bumble Bee (Rimsky-Korsakoff), Sailors' Dance from The Red Poppy (Gliere), Procession of the Sirdar (Ippolitov-Ivanov). HMV 10-inch Mono DLP1170.

Mackerras plays these popular Russian items with great spirit and accuracy and the program is admirably designed to appeal to those who have still to make the acquaintance of the composers. The sound is first rate, though on my pressing the stylus jumped a groove on the first side every time I played it. Newcomers to the Russian school should get much pleasure from this sparkling disc.

★ ★ ★

Ketelby — In a Chinese Temple Garden, Bank Holiday, In The Mystic Land of Egypt, Jungle Drums, In A Persian Market, In A Monastery Garden, Bells Across The Meadows, With Honour Crowned. Played by the Vienna State Opera Orchestra conducted by Armando Aliberti. Westminster stereo WG-W-18071.

The sound is efficiently managed on this disc of unpretentiously popular music. The Viennese orchestra, despite unchallenged accuracy, betray here and there, a slight trace of a foreign accent in these pieces which remain very English, despite their exotic titles.

The vibraphone is horridly out of tune in The Mystic Land of Egypt, and it is interesting to hear the conductor suddenly make up his mind to push the tempo along in the Bank Holiday item. The Jungle Drums are tame enough to allay anyone's fear about travelling through such country. But otherwise this should be a pleasing production for those who like music that is sometimes called "light classical."

★ ★ ★

Schubert — Sonata in A Minor (D.845). Played by Sviatoslav Richter. Parlophone-Odeon Mono recording from the U.S.S.R. PMAO 1049.

Without ever having made an appearance on the western side of the Iron Curtain Richter is acquiring the reputation of being one of the greatest pianists in the world today. And since, according to those who know the set-up, there is little likelihood of his ever coming much further west than Prague, we must be reluctantly satisfied to hear him only on records.

These discs, to date, have revealed him as the possessor of a dazzling technique which surmounts every difficulty without faltering, a touch that can rival the late Gieseking's in delicacy or Rachmaninoff's in power, and a sense of phrasing that never fails to shape the music he is playing with peerless elegance.

To all these virtues can be added an interpretative sense that presents to his listeners the very essence of the music while always remaining stylistically pure. He has been heard to date (on records) in works by Bach, Prokofieff, Bartok, Liszt, Tchaikowsky and Chopin in a bewildering display of versatility, and to these widely differing composers he now adds Schubert.

I have never heard the A Minor Sonata played so exquisitely. Its beauty is chaste without remoteness, its tonal inflections seemingly limitless and its rhythms subtle yet well defined. If you would like to "taste" the disc experimentally I suggest you enjoy the delicate rhythmic adjustments of the Scherzo.

Some of Richter's tempos might strike those familiar with the work as unusually slow, particularly in the Trio. But a bar or so is all that is necessary to accustom oneself to this new pace and, after a few hearings, it acquires the authority of inevitability.

The piano tone is not outstandingly recorded, though adequate, but the playing is incomparable.

★ ★ ★

The Art of Sergei Rachmaninoff, Volume 1. Sonata in B Flat Minor (Chopin), Carnaval (Schumann). RCA Camden Mono CAM14.

These performances by another great pianist of an earlier generation have been taken from 78s and some of the highs sacrificed to obliterate the surface hiss of the originals. But the sound is still acceptable and the surface of my pressing is immaculate.

The playing, however, remains as exciting as ever in the Schumann. Some of the items go so fast that you have to listen carefully to catch every note, but if you do so you'll find them all there. A comparison with Cortot's great recording of the early 1930s is inevitable, and it is difficult to imagine two more different readings of the same work. That they both sound right successfully contradicts those musicians who claim that there is only one way to play any music.

The Chopin Sonata is fine, too, despite its almost aggressive masculinity, though my preference strongly favours the Schumann. The fact that this disc is numbered Volume 1 promises more Rachmaninoff re-issues in the future. To this reviewer they will be welcome.

★ ★ ★

Chopin — Nocturnes. Played by Artur Rubinstein. HMV Mono ALP 1701/2.

These, too, are re-issues on LP of 78s originally recorded between May, 1936, and April, 1937. The transfer has been made with eminent success without in any way of diminishing the elegance of Rubinstein's aristocratic readings.

In all there are 19 Nocturnes. These include, on the first disc, the B Flat Minor, E Flat Major and B Major from Op. 9, the F Major, F Sharp Major and G Minor from Op. 15, The C. Sharp Minor and D Flat Major from Op. 27, and the B Major and A Flat Major from Op. 32.

The second disc carries the G Minor, Op. 37, No. 1 and G Major, No. 2 from the same opus, C Minor and F Sharp Minor from Op. 48, F Minor and E Flat Major from Op. 55, B Major and E Major from Op. 62, and the E Minor from Op. 72.

★ ★ ★

Ballet At The Opera. Dance of the Hours from La Giaconda (Ponchielli), Ballet Music from Faust (Gounod), Triumphal March and Ballet Music from Aida (Verdi), Bacchanale from Samson and Delilah (Saint-Saens), Hymn to the Sun from Le Coq d'Or (Rimsky-

ELECTRONIC A·R EQUIPMENT

SPECIAL PRODUCTS Bulletin!

NOW AVAILABLE

★ POWER TRANSFORMER —PT 2032
For R., TV & H. 10 watt Stereo Amplifier (December, 1959).

★ MODULATION TRANSFORMER —MT 25
For R., TV & H. 10 watt class B Modulator (December, 1959).

★ DRIVER TRANSFORMER —IT 630
For R., TV & H. 10 watt class B Modulator (December, 1959).

For Full Details see your nearest A. & R. Distributor

A. & R. ELECTRONIC EQUIPMENT COMPANY PTY. LTD....MX 1150
378 St. Kilda Road, Melbourne.

SAVE TIME, MONEY AND WORRY . . .
Send your
METER AND INSTRUMENT REPAIRS
direct to our service department for immediate reliable service.
FERRIER ELECTRICAL INSTRUMENTS
43 ALBANY ST., CROW'S NEST, N.S.W. JF 5596
FERRIER

AEGIS
Australia's Own Brand
STEREO & HI-FI UNITS
NEW AEGIS ULTRA-LINEAR Integrated STEREO SIX-88 Amplifier (illus. above) £69/17/6
AEGIS Ultra-Linear Basic 5/10 Amplifier, £40/5/
AEGIS Standard Control Unit £7/17/6
AEGIS Stereophonic Coupling Unit £17/15/
AEGIS Pre-Amplifier Mark 1 ..... £21/17/6
AEGIS Pre-Amplifier Mark 2 ..... £26/15/6
AEGIS Fidelity Radio Tuner Mark 1 ..... £35
AEGIS Fidelity Radio Tuner Mark 2 .... £32/17/6
(Capital City Prices)
If unobtainable locally, write direct to . . .
AEGIS MFG. CO. PTY. LTD.
208 Lt. Lonsdale St., Melb. FB3731.

ELECTRONIC A·R EQUIPMENT

Complete CHASSIS & TRANSFORMER KIT for the MULLARD "5 STEREO 7" AMPLIFIER

A minimum of skill is required to assemble and wire this inexpensive push-pull stereo Amplifier due to complete engineering by Mullard and A. & R.

This Amplifier with its 2 push-pull 7-watt channels is fully described in "Circuits for Audio Amplifiers" and leaflets by Mullard. The layout, engineered by A. & R., enables the completed unit to be used as a table top or bookshelf Amplifier, or it can be mounted in a cabinet.

The kit comprises 3 sections which are available as separate items if required.

UNIT "A" Chassis, sub chassis, control channel, rear plate, front panel, cover, perspex escutcheon plate, panel screws, name-plates, hardware, template, descriptive leaflet with wiring diagram and assembly details.

UNIT "B" Output transformers, Type 4005 (2 required), "Alphasil" grain orientated core.

UNIT "C" Power transformer, Type 1896. Enclosed vertical mounting.

ELECTRONIC A & R EQUIPMENT

For Full Details see your nearest A. & R. Distributor . . .

VIC.—Radio Parts P/L., A. R. Morgath & Co. P/L., Homecrafts P/L., Wallbottles Trades Ltd., Howard Electr. & Radio P/L. SOUTH AUST.—Gerard & Goodman Ltd., 146 Gawler St., Adelaide; QLD.—A. E. Harrold P/L., 121 Charlotte St., Brisbane; Chandlers P/L., Albert & Charlotte Sts., Brisbane; Tracknell Bros. P/L., 157 Elizabeth St., Brisbane; WEST. AUST.—Gregory Electronics C. L. Sequeira & Co., 38 Malcolm Parade, South Perth; TAS.—Homecrafts P/L., 220 Elizabeth St., Hobart; N.S.W. Factory Repr.—R. H. Cunningham P/L., 10 Angas St., Meadowbank. Available from all London Stocks Distributors.

A. & R. ELECTRONIC EQUIPMENT CO. PTY. LTD. 3/6 St. Kilda Road, Melbourne, S.E.1. MX 1150, MX 1159

Korsakoff). Played by the Vienna State Opera Orchestra conducted by Armando Aliberti. Westminster Stereo WG-W-18044.

The stereo here has good spread and is cleanly voiced with a dynamic range that needs treating with respect. The selection of items is aimed at a middlebrow market.

The Viennese musicians respond generously to their Italian conductor, who contents himself with straightforward, nonsense playing of the tuneful music. The orchestral tone is rich and its reproduction resonant. For sampling I suggest you try the delicious little trio of flutes in the Priestesses' Dance from "Aida."

★ ★ ★

Ravel—Alborado del Gracioso; Rhapsodie Espagnole. Debussy—Iberia. Dukas—L'Apprenti Sorcier. Played by the Royal Philharmonic Orchestra conducted by Sir Eugene Goossens. World Record Club Mono. TE214.

The playing throughout these four exacting pieces is always stylish though never very exciting. The opening of the Rhapsodie Espagnole is especially disappointing in the absence of any evocation of a magical Spanish night. I have heard Goossens produce much more atmospheric sounds from the Sydney Symphony Orchestra. The Alborado is played with a care that inhibits its humorous implications.

Some listeners, however, might think these comments a little harsh, or at least hypercritical, in view of the general excellence of the technical accomplishments made manifest here. And at the low price at which it is offered it is a very good buy indeed.

★ ★ ★

Lois Marshall — British Folk Songs. HMV Mono OALP 1671. Arias from Oratorios by Handel, Haydn and Mendelssohn. World Record Club Mono. XE1107.

On these two discs, so different in content, the Canadian soprano displays many sides of her art. In the Folk Songs her method is simple to the point of artlessness unspoiled by the coyness some performers seem to find unavoidable when singing these ditties. She is careful not to over-vocalise them despite her many effective changes of timbre.

The 17 numbers on two 12inch sides have been gathered from many parts of the British Isles. Kennedy-Fraser, Cecil Sharp, Roger Quilter, Benjamin Britten and Frederick Austin supply most of the arrangements. Weldon Kilburn is her exemplary accompanist.

The oratorio disc contains sterner fare. On it Miss Marshall offers Farewell, Ye Limpid Springs with its preceding recitative, Ye Sacred Priests from Handel's Jephta, Blessed the Day, and With Thee th' Unsheltered Moor I'd Tread from Solomon, Let the Bright Seraphim from Samson, and So Shall the Lute from Judas Maccabaeus, all by the same composer.

Haydn is represented by O, How Pleasing the Senses from The Seasons, and With Verdure Clad from The Creation, and Mendelssohn by Hear Ye, Israel from Elijah.

Let the Bright Seraphim and So Shall the Lute might have been improved by slightly lighter treatment, but elsewhere Miss Marshall presents the difficult arias with charming sensitivity of phrasing and accuracy of pitch. Her voice is beautifully even throughout its range and is admirably balanced against the London Symphony Orchestra conducted by Anthony Bernard.

★ ★ ★

Tchaikowsky—Violin Concerto in D Major. Mendelssohn—Violin Concerto in E Minor. Played by Christian Ferras with the Philharmonia Orchestra conducted by Constantin Silvestri. HMV Stereo OASD 278.

I found this performance of the Tchaikowsky one of the most thrilling available when it appeared on mono early last year. It sounds even better on stereo, if one can manage to ignore a slightly sandy surface. Best benefited is the balance between soloist and orchestra, already good in the mono, but faultless here. But the rest of the sound, too, acquires added spaciousness and resonance from two-channel treatment.

Much the same might be said of the Mendelssohn, more transparently scored than the Tchaikowsky, and delivered with limpid tone and impressive precision by both Ferras and the Philharmonia. The Tchaikowsky might not have all the weight of Oistrakh's famous DGG disc, but it offers instead a seemingly guileless but in fact highly sophisticated romanticism that I found most refreshing.

★ ★ ★

Russkaya—Russian and Ludmilla Overture (Glinka), Song of the Volga Boatmen (Traditional), Dance of the Buffoons (Rimsky-Korsakoff), Kammenoi-Oistrow (Rubinstein), Melodie, Opus 42, No. 3, (Tchaikowsky), Meadowland (Traditional). Played by the Hollywood Bowl Symphony Orchestra conducted by Carmen Dragon. Capitol Stereo SP-8384.

This 12-inch of Russian light classics offers excellent stereo played with spectacular expertise. I much prefer Carmen Dragon to Kostelanetz in this field, especially in his choice of arrangements. Oddly, Dragon seldom mentions the origin of his orchestrations, so that his ingenious transcription of the Volga Boatmen's Song is introduced anonymously here.

This is presented as a Fantasia in the Tchaikowsky manner and should appeal to all who like to hear a simple tune juicily harmonised and enterprisingly orchestrated. The Glinka and Rimsky-Korsakoff items are played, as nearly as I could make out, in their original orchestral guise. The Tchaikowsky Melodie is the one Elman made famous under the title of "Hebrew Melody" many, many years ago on a 78.

As played by this combination it sounds as plushy as even Stokowsky could make it. An ostinato rhythm in Meadowland is presumably imitative of Cossack hooves. But the sound's fine throughout.

(Continued on Page 107)

"SAKURA" TR4H TESTER

20,000 OHMS PER VOLT SENSITIVITY

Volts, ohms, M.amps. Size 5¼in x 3¼in x 1¼in. 17 ranges AC and DC.

Post Free £9/3/6 Trade Price

Including Sales Tax, Battery and Test Leads.

With leather carrying case to suit,

£10/2/6

"T.M.K." June Special

MULTI METER TESTERS

AC-DC VOLTS — OHMS—M.AMPS. — CAPACITY — DECIBELS.

MODEL No.	SENSITIVITY AC	SENSITIVITY DC	RETAIL PRICE Incl. Tax £ s. d.	REDUCED TO YOUR COST £ s. d.
	Ohms per Volt			
180	10,000	20,000	19 2 6	12 15 0
MT6D	"	"	16 15 0	11 2 6
320	"	"	15 10 0	10 7 6
MG310	"	"	15 0 0	10 2 6
TP5S	"	"	11 5 0	7 10 0
M.D.	10,000	10,000	8 10 0	5 16 3
MTIAS	10,000	5,000	14 12 6	9 15 3
MT2AS	4,000	2,000	10 19 6	7 6 3
PD3	2,000	2,000	8 10 0	5 12 6
TP5	"	"	7 17 6	5 5 0
TP10	"	"	7 0 0	4 14 6
LC15	Condenser and Resistance Tester		25 17 6	17 5 0

For further particulars please write.

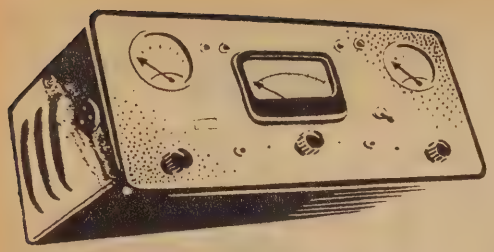
Write for your free copy of our Resistor Colour Code

MAIL ORDERS

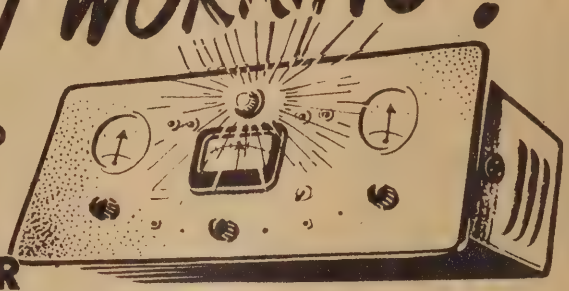
Radio House Pty. Ltd.

296 Pitt St., Sydney

Also available at: 6 Royal Arcade and 760 George Street, Sydney.



IS IT WORKING?



HERE'S A QUESTION EASILY ANSWERED WITH A . . .

TRIMAX

PILOT LAMP HOLDER

- M156 R for MES or MBC Globe.
  M156 T No. 2 Side Contact Telephone Lamp.
- Single hole Panel Mounting. Front loading.
- Convenient size ⅜in diameter 2¾in behind panel.
- Bezel can be fitted with any standard lens colour.
- Bakelite moulding requires no special insulation.

PILOT LAMPS NEED PANELS

•

SEE US FOR ALL YOUR SHEET METAL WORK PANELS

•

CHASSIS, COVERS, CABINETS, MICROPHONE STANDS, MU--METAL SHIELDS and all those special pieces where appearances and finish are so important.

TRIMAX TRANSFORMERS PTY. LTD.

Corner Williams Road and Charles Street, North Coburg, Victoria. 'Phone: FL1203

ACOS MICROPHONES

LAPEL MICROPHONE MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft moulded rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel.
PRICE: £5/19/6.

VIBRATION MICROPHONE TYPE VP1

The VP1 Vibro-Voice has been specially designed for use with guitars, double bass and, in fact, all stringed instruments. With the use of this simple yet effective pick-up, together with a good quality amplifier, any instrument can be amplified. The VP1 has ample output and a frequency range which extends to approx. 6 K/cs. The tough rubber case protects the instruments from damage.
PRICE: £7/15/-.

CRYSTAL STICK MICROPHONE MIC39-1

The MIC39-1 has been beautifully styled as a hand, desk or floor stand unit, and precision engineered to the highest professional standards. A heavy die-cast liner in the microphone case eliminates the possibility of hum pick-up due to hand capacity effects. The use of a special noise-free cable improves screening and gives a greatly increased signal-to-noise ratio.
PRICE: £7/19/6 complete.
Desk stand extra.

CRYSTAL MICROPHONE MIC40

The MIC40 has been pleasantly styled in two-tone colour to give a handsome, quality Microphone of modest dimensions and unassuming price. Ideal for tape recorders with a minimum of stowage space available. £3/19/6.

Sole Australian Agents:

AMPLION (A'sia) PTY. LTD. 101 Pyrmont Bridge Rd., Camperdown. Sydney, N.S.W. Phone LA 6124

Victorian Distributors: DISTRIBUTORS CORPORATION, 403 Bourke Street, Melbourne.

TREES PREVENT EROSION

(Continued from Page 19)

the surface and some is used or transpired by the trees.

Despite these losses, the other effects of the forest in conserving water as outlined above more than offset them and authorities agree that nothing can take the place of a forest for the conservation of water to feed streams, springs and dams.

In addition to the economic value of a forest for its products and its effect on the water supply, there is also its value in the conservation of the valuable topsoil of the land.

BOTH NECESSARY

Now it is obvious that we must have both forest and open land for cultivation, grazing and building. The problem is to remove the forest and vegetative covering of the land without setting up a soil erosion process. The mechanics of soil erosion must, therefore, be studied by the forest manager.

The speed with which erosion occurs is dependent on several factors, among which are the velocity of the water flow, the nature of the soil, the type of subsoil rocks, the type of vegetation covering the soil.

Obviously the velocity of the flow of water is governed to a large extent by the slope of the soil and the physics of this can be stated as follows:—

The erosive power of water varies as the square of its velocity and its carrying power varies as to the sixth power of its velocity. In plain terms this means that if the angle of a slope is doubled, the amount of soil eroded will be quadrupled.

To take a specific example, if the velocity of the water flow is increased from 10 to 20 miles per hour, the weight which can be moved will increase from, say one and a half tons to some hundred tons.

An understanding of this will explain how it is that huge buildings and large rocks can so easily be shifted by flood waters.

When a forest is being exploited, great care must be exercised in the selection of a method for removing the logs of timber from the site. If the process of dragging the logs tears up the soil, erosion gets off to a good start.

Likewise, if the roads from the forest are steep and badly cut about by the hauling apparatus, erosion is again easily started.

The underlying rock and shale governs the rate of erosion to a large extent. For instance, if the underlying rock is shale or other sedimentary rock, as is so often the case, erosion can be very bad.

SOLUBLE IN WATER

The cementing material which binds these rocks together is soluble in water. In addition, these rocks contain many cracks and joints through which the water seeps, loosening the rock foundation and starting off erosion on a grand scale.

The best foundation is quartz, granite and such rocks. The least effective are shales, limestones and sandstones.

If water is clear it will flow with greater velocity than if it is loaded with silt or debris. This fact can help in curing erosion by the fact that water filled with silt from higher ground will reduce its flow down gullies and channels. By placing obstacles across such gullies, the silt is trapped and deposited, thus forming a wall which helps to retard still further the rate of flow.

A simple procedure adopted in some areas is to stretch a piece of wire netting across an eroded gutter down a hillside. This soon becomes clogged with silt, leaves and twigs and the gutter soon fills with silt. Even a log or branch of a tree will often be effective for this purpose.

If a gully is narrow, deep, straight and steep, it is more favourable to a high rate of erosion, because the water is not impeded and the velocity is high. Zig-zagging wide channels are therefore less favourable to erosion, because the friction slows up the rate of erosion.

It is not only water which causes erosion, although water first sets the process going. Once the vegetative covering has been removed, conditions are right for strong winds to blow away the soil. The huge dust storms so often seen in our country areas are merely clouds of topsoil being blown away.

Without proper control of forests, deserts can easily be formed as a result.

IN REVIEW

(Continued from Page 105)

Cziffra Plays Miniatures — Gavotte in D Minor (Lully), Le Tic-Toc-Choc ou Les Maillotins (Couperin), Sonata in A Major, L494, and Sonata in C Major, L.104 (Domenico Scarlatti), Bourree in E Flat Major (Krebs), Andantino in B Minor (C. P. E. Bach), Piano Sonata No. 8 in A Minor, K.310 (Mozart), Rondo in E Flat Major, Op. 11 (Hummel), Polonaise in C Major, Op. 89 (Beethoven). Piano pieces played by Gyorgy Cziffra. HMV ALP 7514/5.

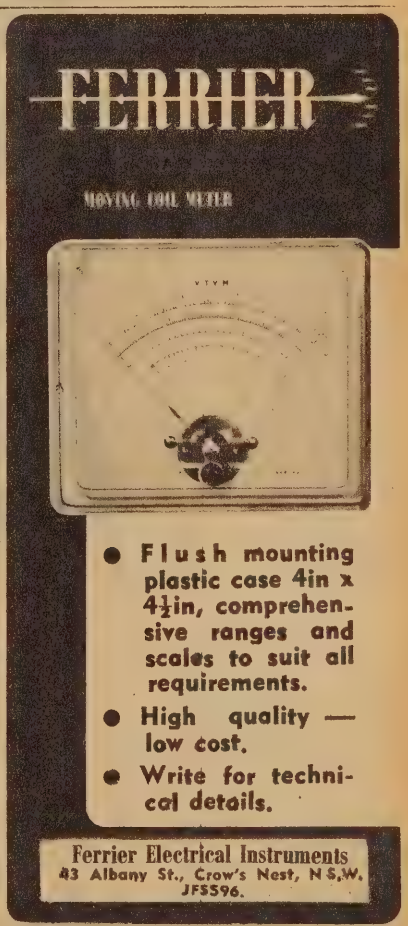
Cziffra is one of the most uneven pianists recording today. Those works that rely for their effect on brio fare best in his hands, so that his first recordings featuring Liszt are still his most successful. Since then he has produced playing that ranges all the way from the beguiling to the exasperating.

This selection seems designed to re-establish his "respectability." For perfect presentation it would require versatility that Richter might envy, but Cziffra gives everything a "go"— with varying success. His respectful treatment of the Beethoven Polonaise restrains his natural exuberance to an extent that leads to an altogether fresh and charming performance, and the Rondo in the Mozart Sonata is a delight.

The recital, too, has the merit of introducing items new to many Australian listeners and others that have not appeared on the local catalogues for many years. The Krebs piece will be of particular interest to musical scholars, slight though it is. But anyone accustomed to Wanda Landowska's Scarlatti will be shocked—and horrified—at what they hear here.

Yet even in his most extravagant exhibitionist mood Cziffra disarms rancorous disapproval by a kind of small-boy innocence in mischief. I suppose one could best describe him by paraphrasing the remark once made about Brahms, "His music sounds better than it is."

I feel certain that no one will play through these discs without deriving considerable pleasure from some of the pieces. But it will be countered by matching irritation at others.



- Flush mounting plastic case 4in x 4½in, comprehensive ranges and scales to suit all requirements.
- High quality — low cost.
- Write for technical details.

Ferrier Electrical Instruments
43 Albany St., Crow's Nest, N.S.W.
JF5596.

Write for Catalogue of Prices

ROYCE DISC RECORDING EQUIPMENT

VIC. BOX 5041Y, G.P.O., MELBOURNE. FB2592
ROYCE RECORDING SUPPLIES, 291 EXHIBITION ST., MELB.
S. A. SCOTT SALES, 99 CURRIE ST., ADELAIDE, LA1201, ML4919.

ARTISTRY IN Metal

Metals play a vital part in our modern civilization, yet man has known and made use of them for countless centuries. Even before the beginnings of history men had learned to fashion delicate ornaments from gold. Indeed, gold was the first metal ever worked by men, who, fascinated by the beauty of this versatile metal, prized it highly and constantly sought after it.

The discovery of copper is veiled in mystery, for how primitive man could maintain sufficient heat long enough to smelt copper ore is hard to tell. Nevertheless, copper was discovered, soon followed by bronze, which was suitable for tools and weapons of war. Roman arms and armour being made almost entirely of it for most of the Roman era.

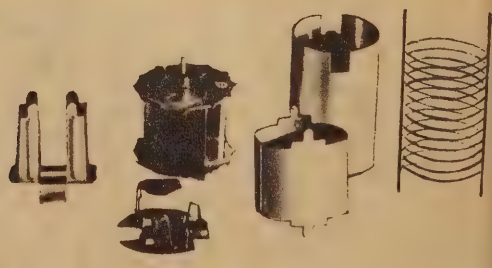
Iron was known over 3,000 years ago, but was not used widely until much later, when the peoples of Eastern Europe, the Caucasus Mountains and the shores of the Black Sea discovered a method of tempering. Gradually iron displaced bronze, until today it is the mainspring of our civilization.

At the Amalgamated Wireless Valve Company, scientists and engineers use precision tools and the utmost skill to produce their own artistry — the intricate metal components for Super Radiotron Valves and Picture Tubes used in so many modern Electronic devices.

When next you see a fine piece of sculpture, such as the striking modern frieze illustrated here, remember that not only it, but also all Super Radiotron Valves and Picture Tubes are truly — Artistry in Metal.

AWV

Super RADIOTRON



AMALGAMATED WIRELESS VALVE COMPANY PTY. LIMITED
SYDNEY MELBOURNE BRISBANE

BOOKS - REVIEWS AND COMMENTS

R.C.A. TRANSMITTING TUBES, R.C.A. Technical Manual. TT-4. Soft cover, 256 pages, 5½ x 8½in, with diagrams, circuits and curves.

Similar in general layout to the popular receiving tube manual, this book is concerned with power tubes up to 4 kilowatt capacity. The initial section deals with valve fundamentals and principles of transmitting, and with considerations involved in the design of high power circuitry.

A section which explains the various terms associated with power valves and valves in general follows and then the book commences on the major portion of the contents—the valve data.

Curves, ratings and characteristics of a great many transmitting valves of American manufacture are listed, including those used in the VHF spectrum. UHF valves and a certain number of radar valves are given but mercury-arc rectifiers and low-power valves such as are used in amateur transmitting applications are also included.

The final section of the book gives details of physical sizes and shapes of the various valves, and also gives a variety of typical circuits using listed tubes and covering transmitting, power supply and industrial electronics applications.

Our copy of the book was direct from the manufacturers' agents, Amalgamated Wireless Valve Co. Pty. Ltd., and the price was given as 14/. (J.R.)

★ ★ ★

THE RADIO AMATEUR'S HANDBOOK — 37th EDITION. Published by the American Radio Relay League. 6¼in x 9¼in, 584 pages, containing photographs, diagrams and circuits.

This, the latest edition of a book well known to the amateur fraternity and most hobbyists, appears to have been brought completely up to date. In the front section of the book, which is devoted to theory, fundamentals of semiconductor devices and microwave gear are included, along with more conventional material.

The construction section of the book is also well up to date, with the inclusion of designs using modern components and techniques. Simple circuits are still included, however, for the benefit of beginners.

Constructional details are given for mobile equipment, including transistor power supplies and a transistor modulator. There are details of receivers operating in the 1296 Mc band and transmitters for the 432 Mc band.

As before, construction details are given for the various types of aerial arrays, both for reception and transmission. Data is given on construction practice, recognised "ham" practice (in America) and interference suppression.

Finally, after the usual valve and tube data section, which now includes transistors, the catalogue section appears. As usual, this shows the current equipment and components available in America.

In all, it is a book of which every amateur or prospective amateur should have a copy.

Our copy of the book was from the Technical Book and Magazine Co. Pty. Ltd., of 295-299 Swanston Street, Melbourne. The Australian price is 46/3. postage 3/ extra. (J.R.)

★ ★ ★

A COMPREHENSIVE RADIO VALVE GUIDE. Book 4 (International Edition) by B. B. Babani, published by Bernards Ltd., The Grampians, Western Gate, London, W.6. Soft cover, 10in x 7½in, 48 pages.

According to a note on the cover, this book lists all receiving valves issued since 1956. It includes English, American, European and some Russian types, as well as all modern English and American cathode-ray tubes.

It should therefore be useful as a supplement to existing valve data.

The information is mainly in table form, giving basic electrical characteristics, electrode structure and pin connections.

Care has been taken to indicate the manufacturer of each type of valve, so that further data can be sought, if necessary, from the manufacturer or their agents.

Our copy was supplied by the publisher, from London. (B.P.C.)

★ ★ ★

RADIO, TELEVISION, INDUSTRIAL TUBE, DIODE AND TRANSISTOR EQUIVALENTS MANUAL by B. B. Babani. Publisher Bernards Ltd., The Grampians, Western Gate, London. Soft cover, 7in x 5in, 208 pages, more than 20,000 types included.

This new book by Babani provides a comprehensive list of equivalents or near-equivalents for industrial, commercial and transmitting valves, diodes and transistors. It also contains a very useful section on television picture tube replacements, with suggestions for changes where such are necessary.

A large section of the book is devoted to wartime or disposal valve equivalents.

The section on transistor equivalents will be very useful, particularly to servicemen faced with the problem of replacing transistors in the imported receivers.

The layout of this book is very clean and easy to follow. In some instances more than one equivalent is given.

The book carries a warning, however, that care has to be exercised in replacing components for which there is no exact equivalent. While it can usefully suggest near equivalents for obsolete valves, picture tubes and semi-conductors, certain points should be checked beforehand by reference to manufacturer's data.

Our copy was supplied by the publisher in London. (B.P.C.)

★ ★ ★

WORLD RADIO HANDBOOK, Broadcasting-Television, published and edited by O. Lund Johansen, Denmark. Soft cover, 8½in x 6½in, 200 pages.

Dated 1960, this fourteenth edition of the World Radio Handbook has been enlarged and expanded. It contains up-to-date information on radio stations operated within the many countries of the world, listing internal broadcast and FM services, as well as those intended for international coverage.

Frequency, power and location is given, along with the name and address of the authority or company operating the station.

The transmission times, regularly recurrent programs and names of leading personalities in broadcasting are also listed.

Another interesting feature of this book is the inclusion of interval signals printed in the form of musical notation.

A complete survey of all television stations is also incorporated, including technical and general information of considerable value.

The basic station lists are supplemented by interesting articles and illustrations from all over the world, related mainly to short-wave reception. Several maps are also included.

The book would be of considerable value to anyone interested in short-wave listening.

Our copy came direct from the publishers, but copies are normally available through technical book-sellers. (B.P.C.)

BACK COPIES OF RADIO, TV & HOBBIES

We have good stocks on hand of back issues for several years past, and readers with incomplete files may be interested in the following list. Prices vary with age, but average about 2/6 per copy. In the case of those listed prior to 1956, there are only a few copies of each date, so first come, first served.

Issues available are as follows: 1960, all copies to date; 1959, all copies; 1958, all copies; 1957, January and August to December inclusive; 1956, May to November inclusive.

1955, October; 1953, May, August, October, December; 1951, September; 1949, June; 1946, February; 1945, February, May, June, September, October, November; 1944, February, March, April, June, August, December; 1943, February, December; 1942, August; 1941, December; 1940, March.

A.E. RADIO

PHONE LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N·S·W

636 KING STREET NEWTOWN—LA7008

AMPLIFIERS

Public Address Range 240v-AC

6 Valve, 10 watt, £14/17/6
6 Valve, 25 watt, £25/7/6
6 Valve, 40 watt, £32/7/6
7 Valve, 20 watt, £22/17/6

Battery Operation

6 valve, 6v, 10 w. £18/15/
7 valve, 12v. 12 watt, £19/15/
7 valve, 12v. 25 watt, £24/17/6

BATTERY—AC OPERATION

6 valve 6 x 240 10 watt, £20/15/
7 valve 12 x 240 12 watt, £21/15/
7 valve 12 x 240 25 watt, £29/7/6

EXTENDED FREQUENCY

240V-A.C.
20 watts Output.
7 Miniature Valves.

Built-in Multi Match output Transformer. Specially suitable for music systems, guitar and where wide-range reproduction is required.

£23/17/6

TV I.F. STRIPS

Complete with valves aligned and tested. Your pick from Steanes R.C.S. Mahood Coils.

from £11/15/-

SEND FOR 1960 BROCHURE ON TV, STEREO AND AMPLIFIERS.

TRANSPORTA 7, 7 TRANSISTOR PORTABLE

Complete kit set, including polished rosewood cabinet.

£24/10/-

WIRED and TESTED,

£27/10/-

TV ANTENNAE

A Complete Range from

£4/15/-

RECORDING TAPE

Hi-coercivity tape, ex A.B.C. Stations

1,200ft spools .. £1/12/6
500ft spools 19/6

D.C. TO 240V A.C. INVERTERS

6V Input 40 watts.
12V Input 60 watts.
32V Input 60 watts.

£9/17/6

6V Input, 60 watts, 50 cycles
12V Input, 100 watts, 50 cycles. Suitable for Radiograms, Tape Recorders.

£16/17/6

MINIATURE STEREOGRAM CHASSIS

For Portable or to easily convert your present set. Uses the latest Frame Grid 6OX8 valves. 4 watts output

£15/15/0

Speakers to suit above. 5 x 7 or 6 x 9. With 15 ohm V.C.

£4/15/0 pair

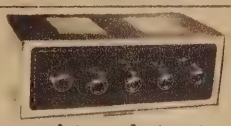
6-VALVE CAR RADIO

Latest Pressmatic Tuning. Ferro-tuned circuit gives remarkable sensitivity and tone.

Complete with Aerial and All Fittings. Fully guaranteed.

£29/17/6

State Voltage 6 or 12.



SINGLE UNIT

STEREO AMP.

R. T. and H. APRIL

Kit set complete to last nuts and bolts and 4 Speakers. Wired and tested £3 extra. £27/17/6

Cabinet, Chassis and Front Panel only £3/17/6.

TV KITSET

23-inch, 110 degree. Latest. Flat, square front.

VISTAVISION

Fringe area tuner. Side tuning. £110 Latest framegrip valves.

Wired and Tested, £12 extra.

R.T.V.&H. 59 KITSET

21-inch, 110 degree. Complete Kitset,

£99

Wired and tested, £110.

STEREOGRAM CHASSIS

Dual Wave with R.F. Stage.
8 VALVE. 6BA6. 6AN7. 6N8. EM80. 12AT7. 6BM8. 6BM8. 5Y3.
2 Rola 8MX Speakers.

£38/15/-

10 VALVE. 6BA6. 6AN7. 6N8. 12AT7. EM80. 2 x EF86. 2 x EL84. 5V4.
2 Rola 8MX Speakers.

£49/15/-

Send for full details on Radiogram Chassis, TV and Amplifiers.

B.S.R. 4-SPEED PLAYERS

Turn over crystal P.U.

£6/17/6

STEREO 4-SPEED PLAYERS £9/17/6

PORTABLE STEREOGRAM

2 toned. Plastic covered Cabinet. 4 speed, Stereo player. 2 Speakers. 6 watt output.

£32/17/6

With built-in tuner, £7 extra.

15 VALVE. 2 x 6BA6. 6AN7. 6AV6. 6BR5. 2 x EF86. 12AT7. 2 x 12AX7. 4 x EL84. 5AS4.
4 Jensen Speakers.

£66/15/-

STRAUSS 21in TV LOWBOY

16 valves and Diodes. 110 deg. Picture in latest narrow-line lowboy consolette cabinet. Direct from manufacturer. Maple, walnut, or rosewood cabinet.

Fully Guaranteed.

£104

AUDIO OSCILLATOR £16/15/-

6 Band 15 Cycle to 500 K.C.

Accurately calibrated. Output 5 volt. Engraved scale. 240V. AC powered. Square wave output extra £2/15/-.

A MUST ON ALL SERVICE BENCHES.

A.C.E. RADIO

PHONE LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N.S.W

AND 636 KING STREET, NEWTOWN — LA7008

VENINGS and WEEKENDS: "KALUA," Hilma Street, Collaroy Plateau, XW5956

DULWICH HILL, UNDERCLIFFE, EARLWOOD BUS AT DOOR, STOP No. 42

AR8 Communications Receivers

2 valve. Converted to 240v A.C. Thoroughly Tested. Re-aligned. Latest Ovaltone Permag Speaker

£34/17/6

NEW VALVES

C8	12/6	6K7	5/
6	17/6	12SJ7	12/6
T801	12/6	12SL7	12/6
1	17/6	6SH7	7/6
C6	12/6	47	12/6
6	12/6	843	£1/10/
A4	15/	957	10/6
37	10/	1625	£1
D6	10/	1629	10/
4TH	£3/-/-	1619	£1
AM8	15/6	9001	8/6
AM6	17/6	RK75	10/
K7	5/-	VR75/30	15/
M8	5/	RK48A	£3
K4	12/6	954	7/6
32	£2/10/	VR105/30	15/
5	9/6	6AC7	5/
34	5/6	EL3NG	12/6
03	12/6	2X2-879	5/
6	15/	866A	15/
7G	7/6	6AJ5	9/6
N7	10/	6SN7	12/6
TW62/6U7	7/6	VR150/30	15/
D8	7/6	6AK5	17/6
F6	12/6	9006	5/
F37	12/6	6AS7	12/6
K8	10/	6A8	17/6
V6	12/6	CK1013	15/
E8	12/6	6SA7	15/
K8	12/6	6SL7	15/
T4	10/	6R7	7/6
8	7/6	6AB7	12/6
3	£1/5/	EF39	12/6
T502	12/6	EK32	15/
A	5/	EBC33	12/6
C6	7/6	809	9/6
V11	3/9	100TH	12/6
		7F7	12/6

NEW RESISTORS

100 assorted. 40 values ¼-½-1 watt

9/6

Postage 2/6

NEW C.R.O. TUBES

3	19/6
PI	£1/2/6
PI-906	£1/7/6
PI	£1/17/6
V1957	9/
V112	10/
CR138	17/6
PI	£2/17/6
CR97	£1/17/6
P7	17/6

IEW VACUUM PUMPS

excellent Low Pressure Air mpressor, 7 c.f. per min., 25lb pressure.

£2/17/6

NEW POWER TRANSFORMERS

240v A.C. 50 cycle primaries. Standard 6.3 filaments.

300 x 300v 40mA	19/6
300 x 300v 60mA	£1/2/6
320 x 320v 80mA	£1/9/6
385 x 385v 100mA	£1/7/6
385 x 385v 150mA	£1/17/6
325 x 325v 150mA	£3/17/6
250 x 250v 180mA	£3/17/6
295 x 295 300mA TV	£6/15/
115v 700mA TV	£4/17/6
750 x 750v 750mA	£7/10/
240v to 6v or 12v 1 amp	12/6

Vibrator Power Transformers

6V 135V 35mA	£0 19 6
6V 300V 125mA	£3 17 6
12V 325V 125mA	£3 17 6

Inverter Transformers

6V 240V 40 Watt	£3 7 6
12V 240V 60 Watt	£3 7 6
32V 240V 60 Watt	£3 7 6
12V 240V 100 Watt	£4 5 0
32V 240V 100 Watt	£4 5 0

RELAYS

6V. 3-pole Miniature	15/
1700 SPDT	7/6
1300 SPDT	7/6
500 x 500 SPDT	7/6
12 volts DPDT, 5 amp	£1
12 volts DPDT	12/6
11 volts A.C.	£1
Hi-speed Polarised relay	£2/10/
400 ohm	12/6
6v. Type 3000	7/6

Hi-lo Phono Transformers	4/6
Canadian Signal Lamps	7/6
Hi-voltage. Lead-thru Insulators each: 15/ doz.	1/6
Hydrometers, Battery Testers	5/9
Multi-strand 4-core Cable, yard	1/
100 yards	£2/17/6
60pf with Vernier	£1/1/
30 pf	10/
Throat mikes, new	3/6

OIL FILLED CONDENSERS

.5mfd 600V	3/6
2mfd 600V	6/6
1mfd 600V	6/6
4mfd 4000V	35/
2mfd 2000V	12/6
2mfd 2500V	15/
4mfd 600V	6/6

TRANSFORMERS

240v-110v. 1,000 watt Projector Transformers.

£8-10-0

GENEMOTORS

Input	Output			
24v.	250v. 100mA	£1	0	0
24v.	550v. 375mA	£2	0	0
24v.	250v. 60mA	£1	5	0
12v.	500v. 350mA	£8	10	0
12v.	1200v. 200mA	£6	10	0
24v.	250v. 100mA. New	£2	0	0
12v.	235v. 50mA	£2	15	0
12v.	350v. 50mA	£2	15	0
24v.	540v. 200mA. New	£2	15	0
24v.	300v. 295mA. New	£2	15	0
12v.	275v. 110mA	£3	15	0

WALTER

New Lifeboat Transmitters. 144 mcs. Battery powered.

9/11

Postage 4/6

COMMUNICATIONS RECEIVERS

AMERICAN NATIONAL H.R.O.

New condition. Air tested. Re-aligned. 500KC to 25meg. Crystal Gate. Noise Limiter. Sig. strength Meter. 240V. AC Power.

£75

A.M.R. 101

A.W.A. version of above Receiver built under licence from National. Claimed by R.A.A.F. operators to be superior.

£65

We believe these receivers to be brand new and the finest to ever leave disposals.

NEW SOUND POWERED TELEPHONE HANDSETS

2 units and 2 wires make complete telephone installation.

£1/9/6

Post: N.S.W., 4/6; Interstate, 7/6.

AT5 TRANSMITTERS

Good order. 2 to 20 mcs. Complete with valves.

£5/17/6

New Coils and Intermediates

Standard or miniature to suit all valves

Coils B/C, 455 KC	9/6
Coils S/W, 455 KC	9/6
Inters	11/6
Loop aerial coils	9/6
Slug tuned H.F. coils to suit 44 mcs.	4/6

TELEPHONES

Standard P.M.G. Type. Pedestal Magneto Phones. Tested. In perfect order.

£6/10/-

AR7 COIL BOX

Band A only. Can be modified for other bands.

£1/9/6 ea.

WANTED

Communications Receivers. Test equipment. P.A. Gear. Large or Small surplus stock. Best prices. Call, write or phone any time.

DYNAMIC HEADPHONES

Low impedance **17/6**

Postage 2/6.

Dynamic microphones, type 7, 12/6

Postage 2/.

No. 19 TRANSCEIVERS

Complete with 15 valves and power supply.

£12/17/6

240V A.C.

TYPE S-POWER SUPPLIES

As used for AR8-AT5 Stations 575V 350mA plus 250V, 100mA Plus 12V DC 10amp. Tested New Condition

£18/17/6

NEW CRYSTALS F243 HOLDERS

Following	Frequencies.
4840	5397
4495	5205
4950	5295
4852	5780
4397	5852
5205	6235

10/- EA.

Postage 1/.

Special price 100 lots.

522 TRANSCEIVERS

Complete with Valves. Excellent Condition.

£12/10/-

522 Receivers. Complete with Valves **£5/17/6**

522 Transmitters. Complete with Valves **£7/15/-**

ELECTRIC CLOCK MOVEMENTS

Complete gear train and motor. Tested.

12/6

Post: N.S.W., 1/; Interstate, 2/.

AIRCRAFT GENERATORS

30V. 200 AMP. Ideal mobile Welders £19/17/6.

28V. 100AMP. £12/17/6.

28V, 60AMP, £10/10/-.

1154 TRANSMITTERS

100 watt output. Complete with Valves and meters.

£5/17/6

AT5 TRANSMITTERS

Complete with Valves, £5/17/6.

NEW SILICON DIODES

OA210 and 1763 Matched Pairs. Pair, £1/5/-; Postage 1/-.

GERMANIUM DIODES

2.0A79. Matched Pairs. 9/6 pair. Postage 1/-.

AMATEUR BANDS WITH BILL MOORE

RAPID INCREASE IN U.S. AMATEURS

Novice and technical class amateurs in the US constitute a major portion of the rapid increase in the US radio amateur population Licence examination methods are a change from those existing in most countries.

SINCE 1954 it has been possible to obtain novice and technical class licences in the U.S. by passing an examination in Morse code, theory and regulations conducted by a radio amateur holding a general, advanced or extra class licence. When located more than 75 miles from an F.C.C. examination centre, conditional class licences can be obtained under similar examination conditions.

There have been a number of complaints of irregularities during these types of examination.

Suggestions have been made that the F.C.C. again conduct all types of examination for radio amateur licences, The F.C.C. turned down the idea in view of lack of personnel to supervise the examinations and, despite some abuses, the system in use for the mentioned classes was working reasonably satisfactorily.

The A.R.R.L. provides some ideas that would help to eliminate suggestions of irregularities. They firstly mention that the examinations be left in the hands of a team from the local radio club.

If there is no radio club located nearby it would be advisable to have another amateur present when an examination is under way. Either method would assist to stem the critics.

Examination arrangements for the mentioned classes of licences are as follows: The F.C.C. supplies instructions and questions for the written portion of the examination and the amateur arranges the code test himself. Amateurs conducting these examinations are requested to afford the applicant every consideration consistent with the regulations. A good oscillator and a quiet room are recommended and the applicant can be given a warm-up run on the code so he can become accustomed to the particular fist of the examiner.

The novice and technical class code test consists of 125 letters sent at five w.p.m. The text must consist of reasonably common English words and every letter of the alphabet must be used once. The conditional class test includes numbers and punctuation marks as well and is sent at 13 w.p.m.

In both code examinations it is required that an applicant must copy correctly for one minute without error in the five-minute test. If he does not have 25 consecutive letters at five w.p.m. or 65 letters at 13 w.p.m. correct, the applicant fails the test. A minute must be covered without error in the Morse sending test. In the written examination no assistance of any kind may be given the candidate.

American amateurs accept a great responsibility in conducting these examinations and with them rests the obligation of seeing that only fully qualified persons operate on the allocated bands.

Two hundred thousand amateurs are now licensed in the U.S., a great number holding novice and technical class licences. It is important that signals are up to standard and do not cause unnecessary interference.

Sunspot minima

A NUMBER of amateurs have been thinking of the prospects of DX working during the rapidly approaching sunspot minima. It is generally accepted that after high sun-spot maxima low minima appear, with the resultant disappearance of DX from the higher HF bands. Most active amateurs remember only the good DX periods of the 1950s and forget the DX trough of 1951-52-53.

John Chalmers, W6NLZ, in QST provides some interesting information on future predictions of sunspot activity. An examination of the past records of sunspots, which incidentally goes back to 1749, shows two peaks in activity in 1787 and 1870. In both cases they were followed by long stretches of low sunspot activity.

Sunspot number only exceeded 140 in those years and again in 1948. The 1958 peak was again higher and it is anticipated the next peak 1968-69 will repeat the number of the 1948 maxima. From then on the peaks will decrease and by 1980 things will be really bad.

Many of today's amateurs will not be concerned with those minima and will concentrate on the 1961-62-63 low soon to be with us. By necessity there will be a migration to 7 and 3.5 Mc and amateurs will be using their ingenuity to erect a 3.5 Mc dipole on the average suburban lot.

U.S. 14 Mc band

IN its findings on the extension of the 14 Mc U.S. telephony allocation to the 14350 Kc edge of the band, the F.C.C. gave consideration to the position of overseas telephony stations operating in this segment.

In essence the arguments for and against the extension ended up as follows. Against: It would reduce the effective amount of space available to CW stations and would hurt foreign telephony transmissions.

In favour: More space was required for expanding U.S. telephony activity and this need was constantly increasing. This portion was used only sparsely by U.S. stations working with overseas stations. Most S.S.B. operations will possibly not agree with the latter contention.

The F.C.C. found in favour of the extension to 14350 after argument that resolved into U.S. versus foreign telephony operation.

They pointed out that foreign stations could still operate below 14200 Kc (if they can find a spot) and that the previous allocation was entirely inadequate for the ever increasing numbers of U.S. amateur stations using telephony.

I.A.R.U. conference

IN June the R.S.G.B. will act as host society at the International Amateur Radio Union Region 1 Division's conference. All I.A.R.U. member societies have been invited to send delegations and already acceptances have been received from Denmark, Finland, France, Germany, Ireland, Italy, The Netherlands, Norway, Poland, Spain, Sweden, Switzerland and Yugoslavia. An extensive agenda will be discussed and the conference runs for five days, Monday to Friday inclusive.

MONITORING "WHISTLERS" ON VLF

MANY amateurs, scientifically bent, during recent years have turned their thoughts and activities to the VHF and UHFs. There is a group, however, who have turned their attention to the VLFs. They listen to "whistlers," eerie radio noises that are audible within the hearing range of humans. All that is absolutely essential to hear them is some means of amplifying the faint signals received and changing them into sound.

The minimum requirement is a wideband amplifier with a gain of 130 db or so, a pair of headphones, plus an antenna. The main type of antennas used are long wires, verticals and loops ahead of the amplifier. A special matching transformer is used in front of the amplifier generally one to 250,000 ohms. To reduce hum level, special filtering is required and a D.C. source for filaments of valves is used in the amplifier.

A "whistler" is generally heard as a broadband of noise, something like hiss, which decreases in frequency with time. A number of amateurs in the U.S. are co-operating with universities and government bodies in recording instances of this phenomenon.

"Whistlers" were first observed in the last century but have now assumed scientific importance, as they have been recognised as evidence of radio waves of very low frequencies along the lines of flux of the earth's magnetic field.

The principal source is from lightning discharges and signals are propagated as radio energy, whose frequency overlaps the audio range. Actually the signal can be heard by the use of an antenna and headphone and whistlers have been observed on telephone circuits.

Early in the conference committees to discuss VHF, technical and administrative aspects will be set up. These will report back to a plenary meeting on the final day of the conference.

The I.A.R.U. is fully operative in Region 1 and supplied observers at the Geneva I.T.U. conference. It provides a valuable exchange of ideas and views between societies for the betterment of amateur radio. The great distances between I.A.R.U. societies in other regions makes similar meetings practically impossible.

The union proves its value in meetings of this kind and the forthcoming convention is certain to assist to improve the lot of amateurs in Europe.

Travel club

THE International Ham Hop Club (June, '59, issue) is receiving excellent support and amateurs on overseas tours are enjoying the hospitality of members.

4S7SW on recent five weeks tour of five European countries met more than 200 radio amateurs. Ken Mitchell, ZS1IR, is the new South African delegate. President of the club is John Dormois, W0GDH, and secretary is George Partridge, G3CED, 17 Ethel Road, Broadstairs, Kent, England.

Amateurs planning overseas tours and wishing to meet foreign operators would be well advised to contact the secretary who will provide details of the club's working.

Picture transmissions

LATE 1959 saw the first amateur trans-Atlantic picture transmissions and experiments are continuing. At that time G3AST received a recognisable picture from WA2BCW. A special authorisation was provided by the F.C.C. for transmission to be carried out on 29.5 Mc. A narrow-band image transmission system was used as this mode does not take up any more space than a normal voice signal. The band width was restricted to 6 Kc.

It appears that there will be more long-distance picture transmission carried out on amateur bands. For the above tests a power of only 25 watts was used. This transmission mode provides an interesting study and another field for amateur working.

70 Mc band

THE 70.2-70.4 Mc band has been reallocated until further notice to the U.K. amateur. The allocation is purely on a national basis but it is hoped that other European amateur radio societies will be able to persuade their authorities to grant a similar 200 Kc in this region. The band shows some of the propagation characteristics of both 50 and 144 Mc. Sporadic E openings have been recorded on a number of occasions and contact made between the U.K. and North Africa.

W.I.A. activities

THE Eleventh Annual Convention of the W.I.A. North Coast was held at Urunga in good weather over Easter. The organisers were rewarded by the excellent attendance. Among the callsigns registered were VR2DA, VK2AIM, 4LW, 4BZ, 2EH, 2PM, 2ASW, 2AGS, 2ZDK, 2ZMO, 2ZCQ, 2VL, 2XO, 2PY, 2AJH, 2XT, 2WH, 2FP, 2AHA, 2JC, 2ABU, 2ACU, 2RU, 2AHH, 2WQ, 2ALB, 2AOR, 2ASZ, 3ALQ, 2AIY, 2DO, 2ASF, 2SB, 2ADT, 2AWQ, 2ADM.

Field events on VHF and HF bands were popular and the winners as follows:

Saturday: 144 Mc Hunt—VK2ZCQ. 7 Mc Hunt—VK2AJH. Gerry Challender Memorial Contest—VK2XT.

Sunday: 144 Mc Hunt—VK4LW. Urunga Scramble—VK2AHH.

Joe Reed, VK2JR, lectured at the April meeting of the N.S.W. division on one of his favourite subjects, "DF Gear." With the aid of slides, tape and transparencies Joe provided an instructive discourse.

Winner of the April, N.S.W., VHF and TVs section's nocturnal fox hunt was Dick Norman, VK2ZCF, second VK2PM, third VK2ZNM. Ten cars competed in the search and eight of them finished. The fox for the event was Keith, VK2ZVL.

Band cuts

MUCH comment has been offered by members of both Federal Houses of Parliament during the month on the subject of the proposed frequency cuts for the amateur service. Questions were directed to the Postmaster-General and were mainly in reference to the 3.5 Mc cut. Full details will not be available until the Postmaster-General receives the official report on Geneva deliberations.

Over Easter an extraordinary meeting of the Federal Council of the W.I.A. was held in Melbourne.

Federal councillors from State divisions of the W.I.A. assembled and, together with members of the Federal executive, spent hours in session.

The meeting was called to discuss the Geneva decisions and to make preparation for action on these changes and generally to plan future activity in this sphere.

The Federal executive plans to provide all amateurs with a printed report on the results of the Geneva deliberations.

An announcement in the R.S.G.B. bulletin for March states that, "The general secretary (Mr John Clarricoats, O.B.E.) has been reappointed for a further two years to serve on the Frequency Advisory Committee set up by the Postmaster-General in December, 1957." This undoubtedly provides a pointer for future activity here in Australia. That is provided the service receives more sympathetic consideration from the authorities.

NEWS OF AMATEUR ACTIVITIES

These pages are devoted to radio amateurs and their activities. Divisional, branch and club notes, or other items of interest to amateurs should be forwarded direct to Mr Bill Moore, Pitt Street, Springwood, N.S.W., for possible inclusion.

R. H. OXFORD & SON PTY. LTD.

Mullard 2 Stereo, fully Wired and Tested, 25gns. Plus 25 p.c. tax.

Mullard 2 Chassis Box, 40/ plus 25 p.c. tax.

Brown Front Panel, 19/6, plus 25 p.c. tax.

R. TV & H. TYPE STEREO, RADIO & TEST EQUIPMENT SUB KITS

Low Input Preamp Box ..	2	0	0
Program Source Box	2	0	0
Printed Brown Front Panel		19	6
Engraved Brown and Red Figures, Aluminium Front Panel	2	0	0
10W or 17W Stereo Chassis	2	5	0
Stereo 5W Radiogram	2	5	0
Stereo Amp. Cabinet, Chassis and Front Panel ...	4	17	9
Transistor Inter Com. Amp.	1	12	6
35W P.A. Amplifier Chassis Cover	2	19	6
P.A. Mixer Unit	2	19	6
17W P.A. Amp	2	19	6

All above Stereo and Radio plus 25 p.c. tax.

TEST EQUIPMENT

Case, Chassis and Printed Front Panel			
Sweep and Marker Grator	5	18	6
Wide Band Scope	10	19	6
Senior V.T.V.M.	4	13	6
Bench V.T.V.M.	2	14	0
Audio Signal Generator	4	13	6
R. C. Bridge	3	4	6
Audio Distortion	3	4	6
Voltage Supply Regulator	4	17	6
Simple Pattern Generator	3	4	6

Any above with Engraved Front Panel £1/15/ extra.

FRONT PANELS

Any Panels for above, Engraved, £2/10/; Printed, 19/6.

INSTRUMENT CASES

Finished in Grey Bake Hammerdok			
MC5A 9 x 6 7/8 x 5¼ ..	1	2	6
MC82A 13 x 8 x 6 7/8 ..	2	0	0
MC87A 15 x 9 x 7	2	10	0
SF7A 7¼ x 7¼ x 7¼ ...	1	2	6

OTHER CASES AVAILABLE.

MC6—MC7—MC67—MC81—MC811—MC79—SF7—SF79—SF71—SF8—SF10.

All Test Equipment and Instrument Cases plus 12½ p.c. sales-tax.

MacKinnon & Nicholls Pty. Limited, 468 Collins Street, MELBOURNE.

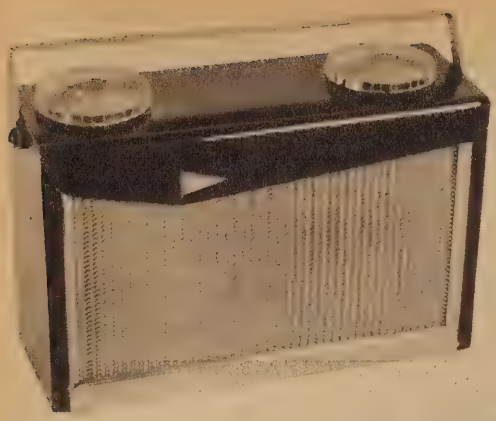
Martin de Launay, Darby Street, NEWCASTLE.

Chandlers Pty. Limited, Charlotte Street, BRISBANE.

R. H. OXFORD & SON PTY. LTD.

97 MARRIOTT STREET, REDFERN. N.S.W.

Telephone Nos. 69.3764 69.3829



PRINTED CIRCUITS

558. Amplifier Audio Transporta 6 & 7
559 RF Section Transporta 6
562 RF Section Transporta 7
569 Audio & RF Section Transporta 4
568 TV Video Strip R & H

20/- ea. Plus 25% S. Tax.

TRANSPORTA IN 4, 6 OR 7 KITS

Small transistor portable 574. Complete set of parts including cabinet, battery and instructions. Size 6in x 4in x 2in.

£15-15-0

plus 25% Sales Tax.

COIL KITS

560 for Transporta 6	76/-	Plus 25% S. Tax.
563 for Transporta 7	105/-	
570 for Transporta 4	54/-	
571 for TV Video Strip	60/-	

DIALS AND KNOBS

453 Dial and Knob 300 pf Gang 10/-
455 Dial and Knob 415 pf Gang 10/-
Above prices are plus 25% Sales Tax.

NOISE SUPPRESSION

Part No.		
11	Aerial Filter Kit	93/4
20	¾ amp Line Filter	31/4
26	¾ amp Line Filter with condensers	60/-
22	5 amp Line Filter with condensers	35/4
24	2 amp Line Filter	37/4
27	2 amp Line Filter with condensers	43/4

Above prices are plus 25% Sales Tax.

TRANSISTOR COILS & IF'S

Part No.		
248	Osc. Coil	7/-
249C	Aer. Coil and Ferrite Rod	14/
174	Single Tuned IF 455kc	11/
175	Single Tuned IF 455kc	11/
176	Dble. Tuned IF 455kc Med. Gain	11/
177	Dble. Tuned IF 455kc High Gain	11/
178	Dble. Tuned IF 455kc Low Gain	11/

Above prices are plus 25 p.c. sales ta

R.C.S.
R.C.S. Radio Pty. Ltd.,

651 Forest Road, Bexley, N.S.W. LW3491–5385
SOLE FACTORY REPRESENTATIVE—VICTORIA—
Distributors Corporation Pty Ltd 403 Bourke Street, Melbourne, MU3908.

For advanced construction . . . low noise . . . reliability . . .

specify **MORGANITE insulated** COMPOSITION **RESISTORS**

Type "AS" ½ watt, 5/32" x ⅜" long
Type "AY" 1 watt, 7/32" x ¾" long

RESISTANCE RANGE: Preferred values from 10 ohms to 10 megohms available ex stock, but range can be extended to both higher and lower values to your order.

ELEMENT . . . Moulded carbon composition.

INSULATION . . . Moulded phenolic composition. Breakdown exceeds 1,500 volts.

TERMINATIONS . . . Silver-coated copper, ensuring easy, certain joints. Firmly moulded into resistor element to withstand close bending without failure of lead on connection.

TOLERANCE . . . Stocked in full range at 10% tolerance. 5% and 20% supplied to order.

Specify also:
MORGANITE CARBON POTENTIOMETERS
"E" series (miniature). "A" series (standard), 1⅛" diameter. Resistance, 1,000 ohms-5 megohms. Rating to 1½ watts.

'Phone, write or call for samples and prices NOW.

Stocked by all Electrical Retailers, but if any difficulty is experienced write direct to us.

THE MORGAN CRUCIBLE CO.
(AUSTRALIA) PTY. LTD.

HEAD OFFICE:
65-67 BOURKE ROAD, ALEXANDRIA, N.S.W. PHONE: MU 1371 TELEGRAMS: "MORGANITE" SYDNEY
117 THISTLETHWAITE ST., SOUTH MELBOURNE, SC 5, VIC. Phone: MX6106. Telegrams: "CRUCIBLE," MELBOURNE

Pacific stations

EASY indentification of the location of U.S. Pacific Island amateur stations an be made from their callsigns. As a umber of countries for DX certificate ward purposes is involved the follow- ng information will be of interest.

Licences are issued within the follow- ng block of call letters. Eastern and Vestern Caroline Islands — KC6AA hrough KC6WZ and KC6YA through KC6ZZ. Rota Island (Mariana Islands) –KG6RA through KG6RZ. Kwajalein nd Eniwetok Islands area, Marshall slands — KX6AA through KX6MZ. Marshall Islands less Kwajalein and Eniwetok areas — KX6NA through KX6WZ and KX6YA through KX6ZZ. Guam—KG6AA through KG6HZ.

Television DX

GEORGE PETERSEN, radio engineer, of Box 568 Ayr, Queensland, was oncerned with the reported reception f DX TV sound broadcasts on chan- el one of a receiver. These were from Peking and South Korea and he con- sidered them as VHF harmonics of egular short-wave broadcasts from ransmitters in the area. George points ut that it is possible to produce good udio from AM signals, via the FM liscriminator under certain conditions. y using a small VHF oscillator it is ossible to pick up AM signals in the 9/56 Mc channel 1 band. A separa- ion of 5.5 Mc is required on FM, but t does not need to be 5.5 Mc for AM; t can be some frequency either side, o there is sufficient unbalance in the liscriminator.

George reviewed his former ideas omewhat on the receipt of a letter from South Korea stating it was considered hat he was hearing FM links between tudio and transmitter. A number of inks is operating in the range between 40 and 50 Mc. He would be pleased to ear from anyone hearing similar signals rom the north.

High-speed code

HIGH-SPEED code runs in excess of the 40 w.p.m. tests the highest peed transmitted over A.R.R.L. station WIAW are broadcast regularly over WINJM on 3.5 and 7 Mc. These trans- nissions are sponsored by the Connecti- ut Wireless Association and practice eriods are provided on alternate Sun- lays. Two amateurs, W8RMH and VE7CQ have been awarded certificates for reception at 60 w.p.m. Runs are made at 40, 45, 50, 55 and 60 w.p.m. and plain English of five minutes dura- tion is transmitted at each speed.

144 Mc working

CT3AE, who made such a name for himself on 50 Mc during 1958-59 has lost his permit for this band. He is currently building for a KW on 144 Mc and looking for a new record on this band. A good deal of the F2 layer DX working of those years was not evident during the early months of this year and the band has fallen away. The forthcoming sunspot minima will un- doubtedly see greater concentration on 144 Mc among VHF DX enthusiasts.

I.T.U. secretary

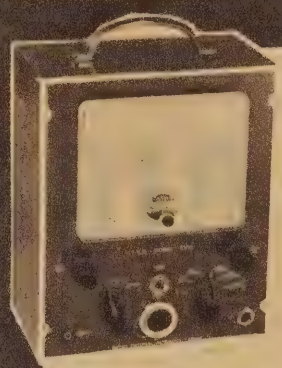
THE new secretary-general of the In- ternational Telecommunications Union is Jerry Cross, W3GG/HB9IA. Jerry is the first American to be appoint- ed to the post and started in amateur radio back in the 1920s. He has been a member of practically every U.S. dele- gation to International Radio Confer- ences in the past. A resident of Switzer- land since 1947 he was successful in obtaining the post over a number of applicants from various nations.

"Pirate" fined

VK9XN turned out to be a pirate in Sheffield, England, who was fined £10 after pleading guilty to operating a transmitting station without a licence. He also used the call G3CPQ but it was the VK9 call that created interest among the locals.

FERRIER

VACUUM TUBE VOLTMETER



MODEL KVM-25

- Price £29 plus sales tax
- 11 megohms input impedance
- Peak-to-peak readings
- Anodised front panel
- Send for technical details

Ferrier Electrical Instruments
43 Albany St., Crow's Nest, N.S.W.
JF5596.

We supply **Radio Accessories,** including Valves, Resistors, Condensers, Transformers, Players and Changers etc., also Sets. **Television Accessories,** including Picture Tubes, Valves. Antennas, Tuners, etc.

Black and Decker and Sher Drills, Sanders and Kits.

Electrical Appliances, including Irons, Steam Irons, Toasters, Percolators, Polishers, Shavers, etc.

Transistor Sets, Miniature 6, Mantel 6 and 7 Car Sets, Car Aerials.

Open week days, 9 to 5; Saturdays, 9 to 12.

DAVIS RADIO CO.

Wholesale Distributors, 6a Annandale Street, Annandale. Tel. LM4556.

Pantechna Pty. Ltd. are extremely proud to introduce from the U.S.A. the entirely new

EMPIRE and GRADO

STEREO CARTRIDGES AND TONE ARMS

Recognised by leading experts as the finest in their field. Both these remarkable cartridges have the extremely low stylus mass of only 0.7 to 0.8 milligrams, not achieved by others and so essential for transparency, naturalness and avoidance of false coloration. No groove wear or needle talk because of such low dynamic mass — hence their superiority.

Both Tone Arms achieve complete dynamic balance at any angle — even upside down. It will be a revelation even to untrained ears when using above cartridges in these gyro-balanced arms as all the fizz in recorded strings disappears, leaving a rich, warm quality typical of massed strings. Hi-Fi enthusiasts will gladly discard other systems for the benefit of such additional qualities.

EMPIRE "88" Stereo Cartridge with Diamond Stylus. Incorporating the moving magnet principle brought to the highest stage of development. Frequency response 20-20,000 cycles plus or minus 2 db. Hum Pickup eliminated. Outstanding stereo channel separation. Both channels balanced plus or minus 1 db. Compliance vertically and laterally 5 micro-cm./dyne. Stylus easily replaced. Fits standard tone arms. Tracking pressure 2-3 grams.

EMPIRE "98" Stereo/Balance Transcription Arm. See above.

GRADO "Master" Stereo Cartridge with Diamond Stylus. A moving coil cartridge of supreme quality for the most critical listener. Each unit is custom-fitted and assembled to almost unbelievable tolerances. Frequency response 10-30,000 cycles. Both channels balanced plus or minus ½ db. Outstanding channel separation. Compliance vertically and laterally 8 micro-cm./dyne. Fits standard tone arms. Tracking pressure 2-3 grams.

GRADO Micro-Balance Tone Arm. See above.

Sole Australian Agents:

PANTECHNA PTY. LTD. 6a Elizabeth Street, Melbourne C1.

Phone MF 8811

7 STORES

MAXWELL'S

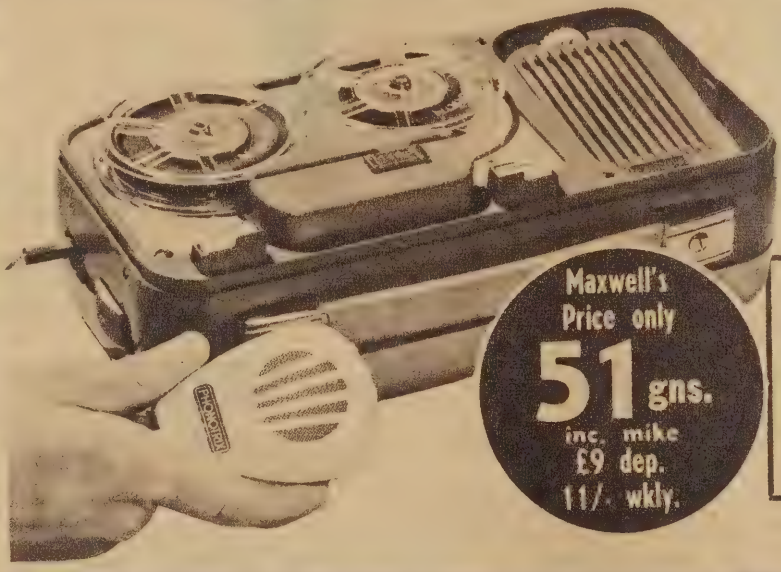
Famous for Fair Dealing since 1918!

MELBOURNE'S LEADING TAPE-RECORDER SPECIALISTS
can offer you Melbourne's

BIGGEST RANGE

OF TOP QUALITY TAPE-RECORDERS

Maxwell's are Melbourne's headquarters for tape recorder enthusiasts, and no wonder! Every famous make and model is available—from tiny portables to the big professional models. All told, there are over 50 models to choose from and trade-ins are more than welcome. You can pay the lowest deposits and weekly terms too—so for tape recorders, see Maxwell's the Specialists.



Maxwell's Price only **51 gns.** inc. mike £9 dep. 11/- wkly.

PHONOTRIX "TRANSITAPE"

This miniature tape recorder needs no electricity supply, and is completely portable. Plays off small inexpensive pencil batteries or even your car battery!

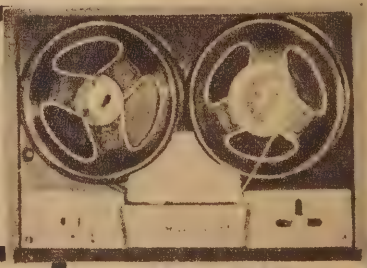
SPECIFICATIONS

Measures 9½" x 5" x 3⅝." Weight only 5lb. Completely transistorised. 50 hours playing time off tiny torch batteries. Tape runs for 44 minutes. Can be used as a straight-through amplifier.

NEW. Elizabethan "Avon"

Efficient compact recorder with full range of recording facilities. Ideal machine for business or home use. £7 Deposit and easy payments. Also, few only Elizabethan "Princess" magnificent 3-speed machine, priced at only 89 gns.

65 GNS



SPECIFICATIONS

Speed 3¾in/sec. ● 5¾in spool, giving 1½ hours' playing on 850ft tape ● Mixing and superimposing of two programs ● Frequency range 60-10,000 c/s ● Four-stage amplifier, 2½ watts output ● Speaker: 7 x 4in elliptical ● Amplifier volume and tone controls ● Independent Amplifier ● Inputs: Mike, radio player, telephone attachment, etc. ● Outputs: Headphone, External I.S. ● Size: 14 x 7½ x 10in. ● Weight: 16½lb. Fully guaranteed.

MAXWELL'S

TAPE-RECORDER CENTRE

358 Lonsdale St., Melb. MY1351

(cnr. Elizabeth St.) also

RUNDLES, 146 Rundle St., Adelaide W5598

Call, phone or write for immediate delivery or demonstration

ON SHORTWAVE BY ART CUSHEN

FAR EAST BROADCAST COMPANY EXPANDS

The opening of a further high power transmitter and introduction of a third program for English listeners are recent events at F.E.B.C. Radio in Manila.

THE expansion of the Far East Broadcasting Company in Manila continues and soon the organisation plans to have the biggest private broadcasting network in the world.

Recently the new 50,000 watt shortwave transmitters were dedicated by the President of the Philippines, Carlos Garcia, a former guerilla leader, who often listened to the same transmitter, when it was operated in San Francisco as KWID.

The new 50,000 watt transmitter and the building which houses the installations were built by donations from friends of FEBC. The new transmitter building, which covers more than 4,000 square feet, houses all overseas broadcasting transmitters. The station is located on five acres of land some 10 miles north of the studios at Radio Central, Manila, and is linked to the studios by FM.

The giant RCA 50,000 watt transmitter cost more than £100,000 when it was first installed as KWID in San Francisco.

The FEBC now broadcasts in 35 different languages and dialects and the main target area is Asia. First tests on the transmitter brought in more than 500 letters from 52 countries, while a later 15-minute test to India brought in 1,200 letters.

The Far East Broadcasting Company in Manila is at present operating 11 stations with a total radiated effective power of half a million watts and to this must be added the new Okinawa stations, which soon will be operating.

The FEBC uses shortwave frequencies of 21515, 17805, 15385, 15300, 11925, 11800, 9730, 6030 and 3345 Kc. Best reception in daylight hours is on 21515, while all the other outlets can be tuned at night. 6030 and 3345 carry local programs and have news in English at 8.00 p.m.

In addition to the Philippines and Overseas Services of the Far East Broadcasting Company in Manila, a new third program in English is now radiated. This is on the air 7.00 to 9.30 a.m. on 17805, 21515; 9.30 to 10.30 a.m. on 15385, 21515 Kc; 5.30 to 7.00 p.m. on 9730, 11930, 15300, 17805, 21515 Kc; 7.00 to 8.00 p.m. on 6030, 11855, 21515 Kc; 8.00 p.m. to 10.30 p.m. on 11930, 21515 Kc.

News is broadcast at 7.45 a.m., 9.30 p.m., 7.00 p.m. and 10.00 p.m. English programs in the Overseas Service are 9.30 to 9.45 a.m. on 9730, 11855, 15385, 17805, 21515; 2.00 to 2.30 p.m., 9730, 11855, 15300, 17805, 21515; 5.30 to 7.00 p.m. on 11855, 15300, 17805, 21515; 11.00 p.m. to 11.30 p.m. on 11920, 21515 Kc; 12.15 to 2.45 a.m. on 9730, 15300, 17805 Kc; 1.00 to 2.30 a.m. on 11920 and 21515 Kc.

Deutsche Welle—New Schedule

THE extension of the broadcasting hours of Deutsche Welle in Cologne has now been put into operation, with 10 different transmissions each day. These are beamed to Far East, Middle East (two transmissions), Africa, West Africa, South America, North America, Central America and North America West Coast.

The Arabic service is also broadcast at additional times and is on the air from 5.15 to 6.00 a.m.; a second tranmission to nine areas of the world has been added. This transmission is on a test basis and the best received here is the one for Japan from 6.00 to 7.30 p.m. on 17815 and 21735 Kc.

The normal Far East service from Cologne has been altered to 4.45-7.45 p.m., and this is carried on 11795, 15275 and 21650 Kc. The North American West Coast transmissions heard in the afternoons is now on the air from 1.00 to 4.00 p.m. on 9640 and 11795 Kc.

The present schedule operated by Deutsche Welle in Cologne is as follows:

Australia and New Zealand:	4.45 to 7.45 p.m., 11795, 15275, 21650 Kc.
Japan:	7.45 to 10.45 p.m., 21735, 17815 Kc.
Middle East:	10.45 p.m. to 1.45 a.m., 17815, 21490.
Near East:	2.00 to 5.00 a.m., 15415, 11795 Kc.
Africa:	3.15 to 6.15 a.m., 17815, 15375 Kc.
West Africa:	5.15 to 8.15 a.m., 9640, 15405 Kc.
South America:	8.30 to 11.30 a.m., 11945, 9735 Kc.
North America, East Coast:	10.00 a.m. to 1.00 p.m., 11795, 9640 Kc.
Central America:	11.45 a.m. to 2.45 p.m., 11945, 9735 Kc.
North America, West Coast:	1.00 to 4.00 p.m., 11795, 9640 Kc.
Arabic transmissions are now:	9.45 to 10.30 p.m., 21650, 17845, 15405 Kc. 5.15 to 6.00 a.m., 15375, 11795 Kc.

New Wellington schedule

RADIO New Zealand has introduced its winter schedule and this includes the use of a special transmission to Antarctica, as well as the normal Pacific and Australian broadcasts.

To the Pacific Islands:

ZL3	11780 Kc.	3.00 to 4.45 a.m.
ZL4	15280	5.00 to 3.45 p.m.
ZL7	6080	4.00 to 7.45 p.m.
ZL2	9450	4.00 to 6.45 p.m.

To Australia:

ZL4	15280	6.00 a.m. to 8.30 a.m.
ZL14	17820	8.45 a.m. to 3.45 p.m.
ZL7	6080	7.00 to 9.45 p.m.
ZL2	9540	7.00 to 9.45 p.m.

To Antarctica:

ZL3	11780	6.15 to 6.45 p.m. Sunday only.

To Samoa:

Special broadcasts in Samoa are now carried on Tuesdays, 6.40 to 6.55 a.m., and repeated at 5.00 p.m. on the normal transmissions.

Los Angeles changes

THE Armed Forces Radio Service on its new schedule has added some new frequencies in its broadcasts from Los Angeles. The overall schedule is from 8.00 a.m. to 1.00 a.m. and is now broadcast on the following transmitters.

KCBR1	21740	200 Kw.	Noon to 5.00 p.m.
KCBR2	21460	50	8.00 a.m. to 5.00 p.m.
KCBR2	9700	50	5.30 p.m. to 1.00 a.m.
KCBR3	17815	50	8.00 a.m. to 5.00 p.m.
KCBR3	11715	50	5.30 p.m. to 1.00 a.m.
KCBR4	15210	100	4.00 to 6.00 p.m.
KCBR5	9740	100	4.00 p.m. to 9.45 p.m.
KCBR5	15315	100	10.00 p.m. to 1.00 a.m.

Suva test frequencies

FOLLOWING the announcement in this page recently of the services of the Fiji Broadcasting Commission in Suva, test transmissions on 6005 and 5980 Kc. have now been heard. The station advises that the first transmitter VRH6 took the air on April 1, using 6005 Kc. and is the first of a series of tests, when both frequencies and aerial designs will be given a check.

VRH6 has the power of 250 watts, and the new VRH5 using 5980 Kc. will also use 250 watts. At first a dipole antenna will be used but an eight-element incidence array is being constructed and will be used by VRH5 when completed. Both VHR5 and VRH6 are on during the normal broadcast times, but as the transmission is of a test nature will be subject to close down when the need arises.

Transmissions have been best received at 5.00 p.m., when a relay of BBC news is carried and, at 7.00 p.m., news from the ABC is also broadcast.

Preserve your valuable gramophone records

with the

"Acos" Dust-Bug

The life of a gramophone record is largely determined by the cleanliness of its groove in the course of playing The stylus travelling along the groove creates a static electric charge on the disc surface and airborne dust is drawn into the grooves to create abrasive conditions which will rapidly destroy the record. Deterioration occurs first in the reproduction of high notes, but surface noise will quickly spread.

The Dust-bug with its accurately shaped points of nylon bristle sweeps the groove in advance of the stylus and the foreign matter removed is trapped and collected on a plush pad, which discharges all static at the moment of playing. Skilful counter-balancing of the device ensures tracking performance is maintained. Records and styli are simultaneously protected from the rasping effect of the stylus point grinding dust into the groove. Expensive records are preserved — reproduction is improved.

The clipping of the Dust-bug to record players or changer arms is a matter of seconds. No further adjustment is required apart from very occasional damping of the plush pad with the antistatic solution supplied free, in easy to apply container.

The "Acos" Changer Dust-bug is doubly important in the case of stereophonic records.

PRICE: £2/15/-.

Exclusive Australian Agents:—

AMPLION (A'SIA) PTY. LTD.
CAMPERDOWN, SYDNEY, N.S.W.

STABILITY

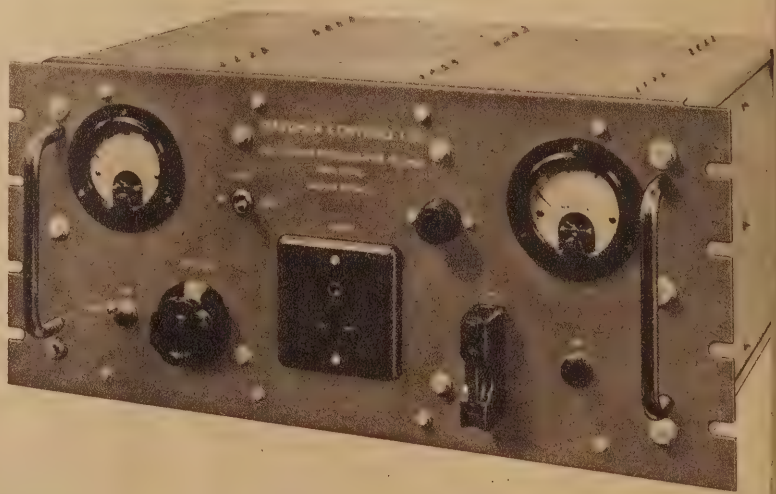
"PAYNECO"

. . . 180v. — 260v.

ZERO WAVEFORM DISTORTION

SERVOMEX A.C.2. M.K.IIB

	AC 2	AC 7
RATING	0 to 9 amps	0 to 30 amps
RANGE	—17.5% to + 8.75%	— 20% to + 10%
RESPONSE	15 volts per sec.	12 volts per sec.



ACCURACY 0.25%.

TRUE RMS. STABILISATION.

EFFICIENCY 95% OR BETTER.

ZERO DISTORTION.

RUGGEDISED CONSTRUCTION.

UNAFFECTED BY FREQUENCY CHANGES [redacted] 45 c/s. — 65 c/s.

NO RELAYS, THYRATRONS OR ELECTROLYTICS.

LOAD POWER FACTORS TO UNITY LEAD OR LAG.

V & I METERING VOLTMETER SWITCHES TO INPUT OR OUTPUT.

FRONT PANEL CONTROL ENABLES USE AS VARIABLE SUPPLY.

Also Servomex D.C. Stabilised supplies from 6 volts to 350 volts up to 10 amps.

RONALD J. T. PAYNE PTY. LTD.
385 BRIDGE RD., RICHMOND, VIC.
JB 1416

Signals from Mozambique

BROADCASTS from some of the regional stations in Portuguese East Africa have been reported to Radio Australia DX Session by a South African listener. The reception of these stations would be possible here in the mornings. The regional station of the Radio Club of Mozambique at Nampula, broadcasts a Portuguese program on 9525 Kc. from 2.30 to 5.30 a.m., with the additional transmission on Sundays from 5.00 to 6.00 p.m.

The Aero Club of Beira has been heard on 3255 Kc. from opening at 2.00 to 6.00 a.m., the frequency in use had some side interference from Lourenco Marques, which at that time is using 3250 Kc. The Catholic Radio, at Beira, has been heard on 3952 Kc. from opening at 2.25 a.m. to sign off at 5.30 a.m.

DX club from Moscow

THE popularity of the DX sessions from shortwave broadcasters is now one of the main features of broadcasting to a world audience, and Radio Moscow is the latest to introduce a session of this nature. The broadcast is on the second and third Monday in the transmission to North America at 2.45 p.m. This is the only broadcast we have heard but expect that this program will also be broadcast in the other transmissions from Radio Moscow. The session to North America Pacific Coast is heard in the 31 and 25 metre bands at good strength.

DX times from Berne

A MAJOR change has been made in the transmissions of the popular DX session from the Swiss Shortwave Service in Berne. The program heard formerly on Friday has now been switched to Tuesday and the sessions extended from 10 to 15 minutes. The Australasian session is now on Tuesday at 5.45 p.m., and a repeat to North America can be heard on Wednesday at 2.45 p.m. The program contains foreign broadcast DX news each second week, the alternate week being taken with news of radio amateur activities. Listeners' reports are also acknowledged. Frequencies for the Tuesday service are 11865, 15305 and 21505 Kc.

FLASHES FROM EVERYWHERE

TUNISIA has made a change in its frequency for its Arabic service and has replaced the 9630 Kc outlet by 6105 Kc; it is heard from 3.00 to 6 p.m., 9 p.m. to midnight and from 3.00 to 8 a.m. and at times to 9 a.m.

AMMAN in Jordan has continued to be received at good strength in Europe, reports the Swiss DX Session. The station is heard on 11812 Kc. The station uses this frequency from 2.00 to 6.30 p.m., 9.00 to 11 p.m. and 1 a.m. to 8 a.m.

MADAGASCAR, with broadcasts from Tananarive, have been heard on 7155 Kc in parallel with 3332 Kc in the transmission from 1.30 p.m. The transmission from 1.30 to 3.30 a.m. is also carried on the same frequencies. The program in French is on 9515 Kc on Sundays at 5.30 p.m. and the regular program from 1.00 to 5.30 a.m. has been tuned on 5010 and 7166 Kc.

AFRICAN signals reported from listeners in Europe include the reception of Radio Gabon on 4774 Kc, which has been in French from 4 a.m. to 7.5 a.m. Liberian station ELWA in Monrovia has English programs from 5.45 a.m. with B.B.C. news carried at 6 a.m. The broadcasts are on 4770 Kc. Radio Congo in Brazzaville has been carrying out test transmissions daily from 4.00 to 7 a.m. and news in French is at 5 a.m. Radio Congo is at present using 4842 Kc. Radio Inter Equatorial, also in Brazzaville, is on the air from 2.30 to 7 a.m. and uses 4795, 7295 and 9545 Kc. Radio Chad also at times relays the broadcasts of Radio Inter Equatorial and Chad has been tuned on 4906 Kc.

GERMANY is reported as being received at very good strength by Leigh Harrison, of Pennant Hills, N.S.W., who is hearing the outlet on 11795 and 11945 Kc at 4 p.m. At this time the Deutsche Welle stations are broadcasting to the Pacific coast of North America and the transmissions to Australia and the Far East, which open at 4.45 p.m., are equally well received. At this time broadcasts are carried on 11795, 15275 and 21650 Kc. English is heard at 4 p.m. in the North American service and at 6 p.m. to the Far East. The East German stations, which identify as Radio International Berlin, continue to provide strong signals at 6 a.m., when they use 9730 Kc for a news bulletin in English. These stations also have the same program on 7300 and 6115 Kc. News in English is also released on these frequencies at 4.00 and 8 a.m.

MONACO, the home of the former Voice of Tangier, now known as Trans World Radio, is soon to be heard on regular schedule over the new 100 Kw transmitter. Latest information is that the station should be on the air this month from Monte Carlo.

DALLAS is the home of the new Global Broadcasters, which we reported last month. The station is under construction and, according to its owners, it should be broadcasting by September; the station will use 15180 Kc with 50 Kw and be on the air to South America from the Texas transmitter site from 9 a.m. to 3 p.m.

GABON has made a frequency change and now appears on 4775 Kc. It carries news in French at 4 a.m.

GUATEMALAN station Radio Nacional station TGRT Tikal, at Flores Petes, operates on 6250 from 11 a.m. to 2 p.m., according to World Radio Handbook.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are Australian Eastern Time.

BURMA, in the overseas transmissions of the Burma Broadcasting Service at Rangoon, now is broadcasting on its 50 Kw transmitter as follows: 9540 Kc. 11 a.m. to 1 p.m., 2.30 to 3.30 p.m., 3.30 to 5.30 p.m.; 6035 Kc, 9 p.m. to 1.15 a.m.; 4795 Kc, 10 p.m. to 1 a.m.

CAIRO has recently made some frequency alterations in its services and at present broadcasts to the home area, 9805, 15475 (formerly 9790, 15390), to Voice of Arabs, 7050, 11665 (formerly 11670); to Middle East and Europe on 12030 Kc (formerly 11990 Kc); to North and South America, 9795, 15475 (formerly 9790, 15390).

GREEK Forces Station Radio Serrai, operates from 3.00 to 5 p.m., 8.00 to 11 p.m. and 1.00 to 5.30 a.m., using the frequency of 7161 Kc with 200 watts. Another Forces station at Prezeve is heard on 7155 Kc at 7.30 p.m. and at 4 a.m.

NETHERLANDS ANTILLES, the site of Radio Corom at Williamstad, Curacao, uses 9655 Kc at present; this frequency replaces the 6170 Kc outlet. The station has been heard to 1.30 p.m.

URUGUAY station, Radio Sarandi at Montevideo, has a new winter schedule which is as follows: CXA60, 15387 Kc, 10 p.m. to 4 a.m.; CXA68, 11885 Kc, 5.00 to 8 a.m.; CXA71, 9530 Kc, from 9 a.m. to 2 p.m.

VACUUM MOUNTED CRYSTALS

for general communication frequencies in the range 3-14 M.C. Higher frequencies can be supplied.

5.5 KCS. TV Sweep Generator Crystals £3/12/6 + 12½% sales tax.

100 KCS. & 1000 KCS. Frequencies Standard Crystals £8/10/- each + 12½% sales tax.

The following fishing craft frequencies are available in F.T. 243 holders: 6280, 4095, 4535, 2760, 2524, 2182, 4620, etc.

Immediate delivery available for all above types.

AMATEUR TYPE CRYSTALS 3.5 and 7 MC BAND

Commercials—from £3/12/6 each plus 12½% sales tax.

Amateur—from £3/-/- each plus 12½% sales tax.

Regrinds £1/10/-

Crystals for Taxi and Bush Fire Sets also Available

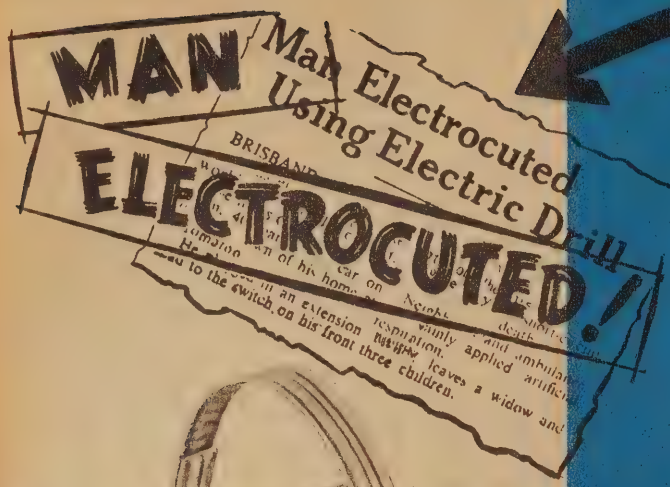
We would be happy to advise and quote.

New Zealand Representatives:—Messrs Carrel & Carrel, Box 2102, Auckland

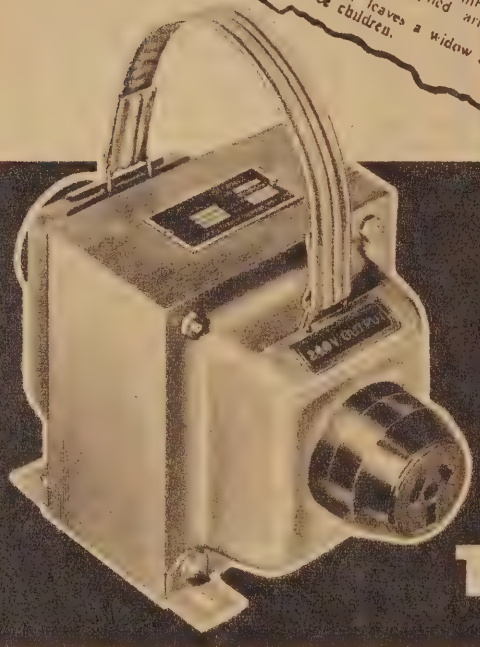
"Contractors to Federal and State Government Departments"

BRIGHT STAR RADIO

46 Eastgate St., Oakleigh, S.E. 12, Vic. 57-6387



Obtain maximum protection!



National

ISOLATION TRANSFORMERS

National Isolation Transformers provide maximum protection when using all types of electrical equipment and appliances.

For example: Electric Drills and Tools, Lawn Mowers, Washing Machines, Domestic Appliances, Extension Leads, can also be used when servicng Transformerless TV and Radio Chassis.

Full technical information available from the Sales Division

NATIONAL TRANSFORMERS PTY. LTD.

42-46 Belmore Rd., Punchbowl. LF9378

VICTORIAN AGENTS:
Australasian Engineering Equipment Co. Pty. Ltd., 476 Latrobe Street, Melbourne. FY2638.

FACTORY REPRESENTATIVES:
Queensland: K. H. Dore and Sons, Brisbane. B0258.
South Australia: B. L. Andrew & Co., Ltd., Adelaide. W1827
Western Australia: I. W. Holman, Perth. BA8190.

ISOLATION TRANSFORMER RANGE:

TYPE	WATTS	CURRENT
IS240/150	150W	0.63 amps.
IS240/240	240W	1.0 amps.
IS240/500	500W	2.1 amps.
IS240/1000	1000W	4.2 amps.

ANSWERS TO CORRESPONDENTS

S.L.M. (Picton, N.S.W.) asks quite a lot of questions about adjustment of television receivers and aerials, and suggests that we run an article on these matters.

A.: We are unable to answer your queries in this section of the magazine, S.L.M., because of the lack of space, but we will certainly keep your suggestions in mind, possibly with a view to future "Answer Tom" articles. We have, however, published information in the magazine concerning adjustments of our own television receivers in the constructional articles and perusal of these may answer some of your queries.

G.E. (East Kew, Vic.) wants to know whether we have described a four transistor portable.

A.: Yes, G.E., the Transporta Four of October, 1959. A similar set also was described in the May, 1959, issue, and this was the final step in a series commencing with a one-stage receiver. These copies are available if required.

E.J.W. (Wagga, N.S.W.) wants to know whether it is possible to connect two transistors in parallel to increase the current gain.

A.: We cannot say whether your suggested description of such a configuration is correct, E.J.W., but the idea has been suggested in certain circuits where insufficient power is available from a single unit. However, the combination would require twice as much power input in order to provide twice the output, so there would be no increase in current again, as such.

L.W. (Tara, Q.) has been experimenting with 32-volt operated audio amplifiers, and wants to know if we can suggest any improvements to his present setup.

A.: We cannot offer much help concerning your first circuit, as we have no details from which to work. However, noise from a genemotor is unusual, in that it is fairly simple to suppress, particularly where only audio signals are involved. However, these devices normally require a filter network similar to that used in a conventional power supply. The audio end of the January, 1950, 32-volt receiver should be quite satisfactory within the limits of its power output, and we cannot suggest any improvements.

W.F.B. (Queenscliffe, N.S.W.) suggests that we consider publishing details of an electronic flash unit suitable for use with movie cameras, being triggered directly from the camera, and operating at 16 flashes/second.

A.: The special equipment for such a device is not available at the present, W.F.B., which makes the idea unpractical for the time being. Flash equipment is available for high-speed work, but it is either too bulky or has insufficient light for photographic purposes.

T.J.B. (Collie, W.A.) asks if we intend publishing details of a transistorised preamplifier suitable for inclusion in an electric guitar, adapting it for use with any low-gain audio system or radio pick-up terminals.

A.: Not for the present, T.J.B., but we will bear the suggestion in mind and may be able to include a small self-contained unit of this type at some future date. Thank you also for your praise of the magazine.

E.R.J. (Melbourne, Vic.) is puzzled by the apparent failure of his mathematics in a recent problem concerning resistors used to shunt a valve filament in a series filament network.

A.: Your method of calculation is correct as far as it goes, E.R.J., but you have overlooked the fact that the HT current for the 3V4 and the 1T4 must also pass through this resistor. The 1T4 can draw 3.5 mA and the 3V4, in a circuit of this kind, up to 10 mA. Adding 13.5 mA to the original 50 mA for the filament gives a total of 63.5 mA and a resistor value of exactly 22 ohms. It would be unwise to alter the order of the series string, since the voltage developed across the filaments is usually used as a source of bias, and this is likely to be upset.

A.M. (Sylvania, N.S.W.) asks if we have considered publishing details for a unit suitable for adapting an 8mm movie projector for "stripe" magnetic sound. He offers the opinion that many enthusiasts of this gauge are interested in adding magnetic sound to their films, but are deterred by the very high cost of commercial units. He adds that the method of sound synchronism by complex couplings with tape recorders is generally unsatisfactory.

A.: We agree that the sound coupling using tape recorders is not very satisfactory, A.M., due to complicated operating procedures and devices. We also agree that the only really satisfactory answer to date is the striping of films and that, in general, the units available are very costly. We are keeping these facts in mind and may, in the future, be able to develop such a device for home construction. For the present we have no definite plans concerning a unit of this type. We did publish details of the various systems, however, in the September, 1955, issue of the magazine.

Dr. J.H.C. (Blackburn, Vic.) offers some helpful suggestions about switch-tuned test oscillators, and suggests that we publish details for a transistorised version of this instrument.

A.: We will certainly bear your suggestions in mind, J.H.C., and may be able to develop such a unit in the future but, for the present, we have no plans regarding a unit of this type.

M.B. (Bellevue Hill, N.S.W.) is sponsoring a school radio club and is anxious to hear from anyone who may have radio parts on hand which schoolboys could use in making simple receivers, etc.

A.: We cannot undertake to publish your request in the form of a free advertisement. However, some reader may be in a position to help you. (The address: M. Bishop, Senior Science Master, Cranbrook School, Victoria Road, Bellevue Hill, N.S.W. FM5039, FM3650).

RADIO, TELEVISION AND HOBBIES QUERY SERVICE

TO assist our readers, "Radio, Television and Hobbies" conducts a technical query service. Conditions governing this service are set out below:—

(1) Requests for copies of circuits or technical queries requiring an answer through the post must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(2) For the 2/ fee, we will supply circuit data, as available, for up to three projects. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. As a rule, requests for circuits will be answered more speedily if they are clearly identified and not complicated by questions requiring the attention of technical personnel.

(3) The technical query service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits.

(4) The Editor reserves the right to return query fees or to limit the scope of an individual reply, where it is felt that a partial answer will be better than none at all. Please note that the inclusion of an extra fee does NOT entitle correspondents to special consideration.

(5) In addition to the normal query service, chassis blueprints are available for most of our projects, showing the position of all holes and cutouts for metal-working but containing no details of wiring, etc. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in x 8in glossy print; postage 9d extra.

(6) Letters should be addressed to the Technical Editor, "Radio, Television and Hobbies," Box 2728, G.P.O., Sydney.

(7) "Radio, Television and Hobbies" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications of merchandise must be obtained from our advertisers.

(8) Technical queries are not answered by telephone.

WALTHAM TRADING Co.

VALVE BARGAINS

6AJ5	9/6	7E5	5/
6C4	5/	7W7	2/6
6C8	7/6	12A6	7/11
6G6	12/6	12C8	10/6
6H6	1/6	12K8	12/6
6J5	12/6	12SR7	4/6
6J7	4/9	12SJ7	9/6
6K6	6/9	12SK7	10/6
6K7	3/11	25L6	12/6
6K8	6/9	802	25/
6L7	12/6	807	19/6
6R7	12/6	815	29/6
6S7	12/6	913	19/6
6SC7	12/6	954	1/6
6SF5	7/6	958	1/11
6SH7	2/3	1625	12/6
6SJ7	12/6	1626	5/
6SN7	12/6	1632	12/6
6SR7	12/6	1638	7/6
6U7	4/9	2051	15/
7A6	5/	7193	1/6
7A8	5/	AV11	1/11
7C4	5/	EF50	1/6
7C5	5/	RL18	5/
7C7	1/11	VR135	7/6
1A5	7/6		
1D8	8/11		
1G6	7/6		
1H6	5/		
1J6	7/6		
1K5	7/6		
1P5	1/6		
1T4	4/6		
2V3	15/		
2X2	6/9		
6AC5	10/6		
6AC7	2/9		

Please add postage

THE GREATEST SMALL MULTIMETER

SANWA MODEL SP.5

This high quality multimeter now priced to compete with inferior models. 2,000 ohms per volt AC and DC. With the following comprehensive range of measurements.

Voltage AC/DC 0-10v, 50v, 250v, 500v, 1,000v.

Current 0-500 micro amps, 25mA, 500mA.

Resistance 0-10k ohms, 1 megohm.

Capacitance 0-.03 Mfd, .5 Mfd.

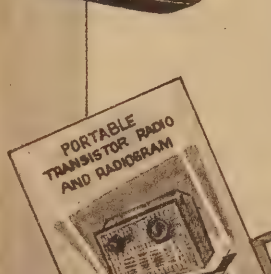
Decibels -20db to +22db, + 20db to + 36db.

Special resistance range 0-100 megohms, on 250 volts DC.

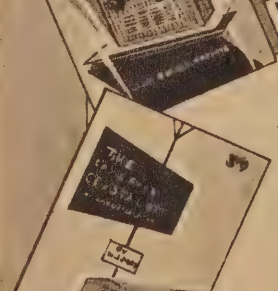
Complete with batteries and test leads.

NOW £6/17/6

Packing and Registered Post 6/



BOOKS ON RADIO



Book No.		
68	Frequency Modulation Receivers	3/9
83	Radio Instruments and their Construction	3/9
86	Midget Radio Construction	5/3
96	Crystal Set Construction	1/6
97	Practical Radio for Beginners	4/6
102	40 Circuits Using Diodes	4/6
104	Three Valve Receiver	2/3
107	Four Valve Receiver	2/3
115	Constructors' Handbook of Germanium Circuits	3/9
126	The Boy's Book of Crystal Sets	3/9
133	Radio Controlled Models	7/6
144	Valve and TV Tube Equivalents	7/6
151	Transistor Superhet Receiver	11/3
155	Portable Transistor Radio and Radiogram	3/9
156	Transistor Circuits Manual	3/9

Books Post 6d each

PERSPEX SHEET

Brand new 1/8 inch Perspex.

12in x 18in 21/
12in x 36in 39/6
3ft x 2ft 79/6
3ft x 4ft £7/15/
Unused ex air force 3/16 inch Perspex.
Approx. 12in x 16in. Only 19/6
Curved 18in high 14½in wide.
Only 25/

Post 4/- per sheet

ALCLAD SHEET

ALUMINIUM ALLOY SHEET

16in x 18in 7/6
24in x 12in 8/

Packing and Postage 4/-

Miniature Motors

3-volt battery operated motors. The ideal power units for your model trains, cars or boats. Reversing polarity reverses motor.

Model No. 45 . . . . . Only 8/6
Model No. 55 . . . . . Only 10/6

Package and Postage 1/6

Magnifying Glasses

Imported magnifiers for reading, stamp collectors or hobbies.

3inch diameter 17/6
2½inch diameter 12/6
1¾ inch diameter 4/6

Packing and postage 1/6

Carbon Microphones

Complete with phone plug and lead, can be used wherever a carbon microphone is required, also ideal for making inter-comm. sets.

Value plus at . . . . . 7/6 each

Packing and postage 2/6

CRYSTAL SET PARTS

Build your own crystal set with these imported parts.

Slug Tuned Coil, complete with instructions, fixed condenser and knob only 16/6

Germanium Diode 3/6

Crystal Earpiece (alternative to headphones). Only 10/-

High Impedance Headphones. Only 27/6

Aerial and Earth Terminals (set of 3) 3/-

Small Plastic Cabinet (6 inch wide). Only 7/6

Aerial Wire 3/6

The above parts make an excellent crystal set.

Packing and postage 9d per part or 4/- full set

MAIL ORDERS TO—
(Sorry No C.O.D.)
Please write to your nearest Branch.

SYDNEY
96 OXFORD ST.
and 463 PITT ST.

MELBOURNE
229 ELIZABETH ST.

ADELAIDE
243 RUNDLE ST.

Perth customers contact G. A. ANDERSON, 328 MURRAY STREET.

ANSWERS TO CORRESPONDENTS

D.R. (Ballarat, Vic.) sends in details of a novel miniature crystal set which he constructed in a matchbox using one of the newly available slug-tuned coils.

A.: We appreciate your letter, D.R., and we will file the details of the set for possible future use in the "Reader Built It" feature of the magazine.

S.C. (West Pymble) asks if a variable capacitor could be used instead of the 0.1 mfd fixed capacitor in the transistorised Code Practice Oscillator of October, 1959.

A.: It would be possible to use a variable capacitor instead of the 0.1 mfd fixed capacitor, but it is not practical, as there are no variable capacitors made with values near the 0.1 mfd quoted. It would no doubt be possible to gang about 90 normal tuning capacitor sections together, to provide the necessary amount of capacitance, but things would end to be a trifle bulky.

If a different note is required from the unit, it is quite in order to substitute various values for the 0.1 mfd capacitor. Larger values will give lower notes and smaller values will give higher notes.

I.C.B. (Seacliff, S.A.) sends in a number of questions on theoretical points, and suggests that EL34 valves can be used with high supply voltage in sweep circuits for 12-inch electrostatic cathode ray tubes in TV circuits.

A.: Thank you for the hint, I.C.B., and it will possibly aid readers who are endeavouring to use tubes of this type. Your questions will take quite a large space to answer adequately, so we are unable to answer them in this section of the magazine. However, we are filing them for possible future use in the "Answer Tom" section.

I.E. (Ormond, Vic.) asks if the coil former and can from a commercial miniature radio oscillator coil can be used to build the output coil in the "Pentode TV Tuner," of February, 1957.

A.: This would be quite in order, I.E., providing the existing coil and small resonating capacitors are removed. This is, of course, assuming that the unit has a ferrite slug, which is suitable for use at 30 Mc, to tune the coils by screwing it along inside the former. If the coil former is a different diameter to the suggested one of 8 mm some small adjustment may be needed to the number of turns to achieve resonance.

E.R.B. (Newborough, V.) wants to know if we can supply a circuit for a VCR97 CRO tube.

A.: The VCR97 (also known as CV1097 and ECR60) is, in general, similar to the 5BP1 and may be used in circuits designed for the latter with only minor alterations. However, it is physically larger and may not always suit a case or layout designed for the 5BP1. We have a number of 5BP1 circuits on hand and we would be happy to select one if you care to let us have details of the general requirements for the instrument.

C.R.H. (Christchurch, N.Z.) wants to know the value of feedback resistor and capacitor to be used in the 10-watt Stereo

(Continued on page 128.)

AMPLIFIER FOR TAPE DECKS

(Continued from page 44.)

it around the mixing components to reduce this pickup.

The layout of the function switch is also rather critical, as input and output signals are present, as well as erase, high tension and heater voltages. As can be seen in Figure 2, we found it necessary to place a shield between the second and third sections to prevent feedback.

We made this shield from an old clicker plate, from which we removed the indent balls, "C" washer and spindle and then knocked out the bush. The switch was then disassembled and the spacers between the second and third sections removed and cut in halves. The switch was then assembled with the shield plate in position equidistant from the two sections, using the half spacers to space it correctly.

The use of a 15 ohm monitor speaker may increase feedback tendency, due to the higher signal voltages present in the function switch. It is thus particularly important that the switch decks and sections be wired exactly as shown.

Another possible source of feedback is capacitive coupling between the 6BQ5 and the function switch. If this is encountered a small shield plate (about 3in x 5in) may be mounted upright on the chassis between them.

It should be noted that the earths are made at two main points; one at the lower end of the pickup-replay pot, called the "input" earth, and the other on the small tagstrip on the tone control pot, which mounts the record network components. This earth has been called the "output" earth and is returned to the under chassis circuitry via the speaker leads.

In order to minimise hum problems caused by hum loops in the input leads, the leads coming to the control panel from the two pre-amp outputs do not have their braid earthed at the valve ends, but only at the panel end. At the valve end the braid is carefully cut back and insulated with a short piece of larger diameter spaghetti.

The hum experienced in the prototype unit was very low, incidentally: the only hum which proved apparent being picked up by the replay head. This type of hum will depend on the deck and type of heads used.

The underchassis layout is quite normal, with conventional audio practice followed for the amplifier proper, and the bias oscillator isolated from the main amplifier.

Such then is the story of our general purpose tape amplifier. It embodies quite a number of new and novel features apart from its good versatility, and the performance of a recorder built using this circuit should be limited mostly by the quality of the deck and heads.

Let's Buy An Argument

(Continued from page 95.)

with a spacing of three microseconds.

"Now one microsecond corresponds to a path difference of 0.186 miles, equals 985ft or approximately 1,000ft.

"At the receiver, the linearity could be adjusted (although this is not strictly necessary) before marking the position of the bars on a strip of paper temporarily fixed across the screen.

"(3) The transmitter would then put up a spike giving a single vertical bar, one-quarter-inch wide on the screen. The displacement of the ghost can then be measured on the prepared scale and converted into path difference.

"(4) If ellipses were plotted from three such results for suitable azimuths at the transmitter, the ghosting object would be pinpointed.

"Yours faithfully, A.L."

My reaction to this letter, I am afraid is to brand A.L. as a supreme optimist.

While I have no doubt that station engineers and management have every interest in seeing that viewers receive a good picture, I can hardly visualise them trying to organise or being organised into a general test transmission of this nature.

Nor can I imagine too many servicemen or dealers wanting to buy into the venture.

And, even if they did, there remains the further serious difficulties which I raised at the time.

(1) The polar diagrams of typical receiving aerial installations are so random in respect to lobe details that many receivers would "see" ghost-producing objects which others would ignore and vice versa. There would therefore be serious risk of completely erroneous findings.

(2) The task of pinpointing objects on maps available to the average person, even quite large maps, is much more difficult than one might imagine at first glance.

I'm afraid I can't get wildly enthusiastic, therefore, about A.L.'s contribution.

However, I have included his letter partly for another reason. Maybe there is a purely personal explanation for it, but I have heard very little mention, of late, of ghosting problems. A year ago, we seemed to hear of little else.

Is it that television aerial manufacturers have solved the problem?

Perhaps they have minimised the problem in a proportion of the cases but I doubt that they have managed to solve it en masse.

Is it that viewers have come to accept the inevitability of ghost effects in some areas?

Perhaps.

Or is it that they are less critical than heretofore, when pictures were a novelty and received their critical attention?

This could well be the answer in many cases.

I can't quite forget the words of a serviceman, which I heard recently:

"What's wrong with the picture? It moves, doesn't it?"

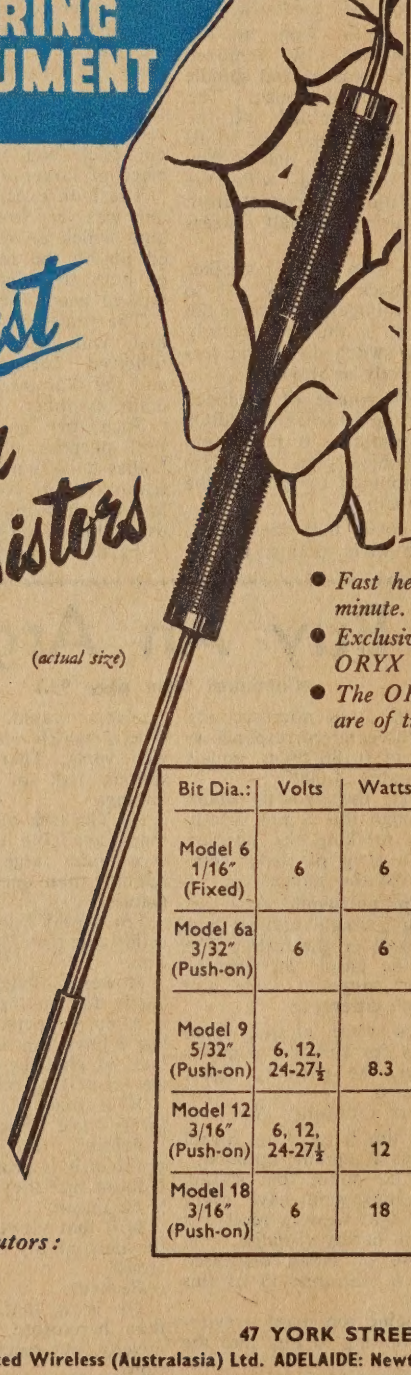
ORYX

(LOW VOLTAGE)

MINIATURE SOLDERING INSTRUMENT

A must for Transistors

(*actual size*)



PROTECT YOUR TRANSISTORS WITH ORYX

There is a danger of damage when soldering to transistor leads, due to A.C. leakage currents. The use of a low-voltage transformer supply, with earthed secondary is therefore recommended. Take care also that too much heat is not applied to flying leads. The ORYX iron, and a heat-sink such as heavy pliers gripping the lead between the contact point and the transistor, will ensure protection.

- *Fast heating element, ready for operation in less than one minute.*
- *Exclusive design features resulting in universal acceptance of ORYX as the standard miniature soldering instrument.*
- *The ORYX long life element will outlast several bits which are of tight push-on fit.*

Bit Dia.:	Volts	Watts	Nett Weight	Length	Recommended Use
Model 6 1/16" (Fixed)	6	6	0.25 oz.	6"	Electrical measuring instrument fine assemblies, hairsprings, R.F. pick-up and speech coils, hearing aid sub-assemblies, etc.
Model 6a 3/32" (Push-on)	6	6	0.25 oz.	6"	As for Model 6 (for extremely delicate work only).
Model 9 5/32" (Push-on)	6, 12, 24-27½	8.3	0.25 oz.	6"	Hearing Aids, Radio and TV Sub-assemblies, Coils, Electronic Instruments, Model Construction, Electro-Medical, etc.
Model 12 3/16" (Push-on)	6, 12, 24-27½	12	0.5 oz.	6.25"	Radio, Television, and Telecommunications assemblies.
Model 18 3/16" (Push-on)	6	18	0.75 oz.	7¼"	For heavier work, heat capacity equivalent to that of most 80 watt soldering irons.

Australian Distributors:

47 YORK STREET, SYDNEY

MELBOURNE: Amalgamated Wireless (Australasia) Ltd. ADELAIDE: Newton McLaren Ltd. PERTH: Atkins (W.A.) Ltd.; Carlyle & Co. (19 Pty. Ltd.; A. J. Wyle Pty. Ltd. BRISBANE : Chandlers Pty. Ltd. HOBART & LAUNCESTON : Amalgamated Wireless (Australasia) Limit

MSP3.5

WATTS COME BY THE BILLION

(Continued from Page 7)

The responsibility for the distribution f power from the Commission's substations is mainly held by Local Governent bodies. These include Municipal nd Shire Councils and County Councils epresenting a number of municipalities r Shires. These bodies purchase power rom the Electricity Commission in bulk t a high voltage substation.

The Councils then undertake to disribute the power at voltages ranging up o 33 kV, but the most popular voltage n N.S.W. is 11 kV. This is reduced ocally to the standard of 240/415 volts or supply to their consumers, by means f pole mounted transformer substations. he Councils erect and maintain their wn electric power lines and provide number of auxiliary services to their onsumers as well.

The system of low voltage lines used y the Councils is of necessity much nore dense than the major power lines. lot only has every street to be reticuated, but their poles must be closely paced in order to attach the service ires to each house.

Low voltage mains are usually of fair heavy copper section and, because of ne adverse effect of voltage drops due o loads, are usually limited to lengths n the order of half to one mile. In ensely populated areas it is often more conomic to provide a greater number f pole mounted low voltage transormer substations and keep the lengths f line shorter.

With the popular acceptance of teleision the problem of maintaining conant voltage has become more important.

SINGLE WIRE SYSTEMS

In rural areas the use of single-wire-arth return lines is becoming more widepread in an attempt to provide power o sparsely settled country areas at a easonable cost. These usually operate at 2.7 kV or 19 kV and a separate transormer is provided at each farm. A lot f investigation has been carried out for many years into the use of such systems.

Limitations on the use of single wire ansmission lines are imposed by the ostmaster-General's Department because of the possibility of telephone interference by induction between the line nd telephone conductors. However, ich interference seldom occurs, mainly ecause these lines are usually constructd through farm lands remote from hone lines.

The lines in all cases so far are isolatd electrically from main power lines y means of an isolating transformer to confine the passage of earth currents to he local area. Some experiments have ecently been carried out to determine he distribution of earth current when n isolating transformer is not used but date no results of the tests are available.

The standards of construction of ower lines is controlled by the Elecicity Authority of N.S.W., which issues egulations from time to time governing he various factors involved in safe practice.

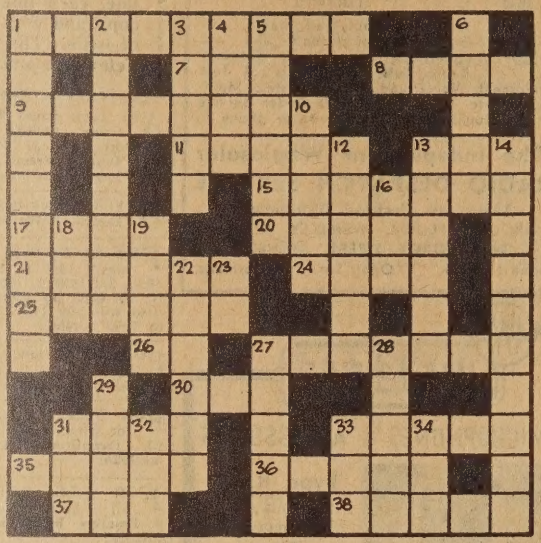
Regulations also exist to ensure that l personnel working on the construcon and maintenance of power lines are roperly trained in matters of safety. Regular instruction is given to line workers in the use of artificial respiration methods and first aid.

Transmission of electric power is not confined to overhead lines. There is a network of underground cables throughout the metropolitan area, mainly associated with power station interconnectors. Cables operating at voltages up to 132 kV are in use at present.

Cable routes throughout the inner suburbs often involve crossing waterways. Laying of submarine cables requires careful planning and considerable equipment.

A much more difficult task lies ahead. It is proposed that a number of submarine cables will later link Bunnerong Power Station to Kurnell, crossing the entrance to Botany Bay to form a further extension of the Interconnected System of the Electricity Commission of N.S.W.

THE R., TV & H. CROSSWORD No. 74



ACROSS

1. Crest amplitude.
7. Institute of Radio Engineers (abbrev.).
8. Distorts under influence of gravity.
9. Amount remaining.
11. Famous German battleship.
13. Male offspring.
15. Legendary medieval character.
17. As well as.
20. Natural logarithmic ratio unit.
21. Position comfortably.
24. A pleasure resort.
25. Covered.
26. In an operating condition.
27. A flower.
30. Playing card.
31. Two of a kind.
33. Beach suburb of Sydney.
35. Unit of capacitance.
36. Awaken into activity.
37. Base of decimal system.
38. Hard natural silica.

DOWN

1. Describes transmission of current through a valve.
2. "X" co-ordinates.
3. Picture information.
4. Type of lily.
5. Aerial connection to receiver.
6. Eskimo residence.
10. Horizontal.
12. Discoverer of natural logs.
13. Confession, as to a priest.
14. Cancellation of grid-plate capacity.
16. Edward (colloq.).
18. Lion (Latin).
19. Man's name (European).
22. Type of cathode ray tube.
27. Swings obliquely.
28. Increase.
29. Cut away.
31. Tap gently.
32. Man's name.
33. Common conductor.
34. Young (prefix).

Last month's solution

P	E	N	T	A	G	R	I	D		A	V	A		
H		A		U		I		O	H	M	I	C		
A	U	T	O	D	Y	N	E		A	P	I	A		
S		U		I		G	A	U	S	S		C		
E	A	R	L	O	B	E	S		T			I		
D		A	I	M		D	E	N	Y			A		
E		L	E	E	R			E		M	A			
T			S	T	A	G	G	E	R	E	D			
E	R	A		E	D	G	E	D		S	A	P		
C		S	A	R	I		M	L	A		P			
T		I			A			E	R	A	T	O		
O	D	D	S		T				A		E			
R		E		D	E	S	I	G	N	E	R	S		

ALWAYS RELY ON R.D.S.

R D S Stockists of Television parts, Picture Tubes and Turrets

We can supply all Radio and Electrical Components and are agents for the famous Hotpoint Radio Sets. Distributors of Test Equipment, Valve and Circuit Tester, Multimeters, etc A complete Mail Order Service for the Countryman. Call, write or phone to

The independent Wholesaler
RADIO DESPATCH SERVICE
Radio and Electrical Distributors,
GROUND FLOOR, WEMBLEY HOUSE,
841 GEORGE STREET, SYDNEY.
Phone MA1876. Open Saturday Mornings.

AWA RONETTE
MICROPHONES & ACCESSORIES

Type R572
£19/3/3
High Impedance

Type
R572/L
£25/3/3
(low impedance, 200 ohms) duo cell omni-directional.
Other types also available from

CHANDLERS LTD.
Albert and Charlotte Streets, Brisbane;
and leading wholesalers.

WHY GO TO TOWN?
Buy at ease (no parking worries).

We are Wholesalers for Goodmans, Wharfedale, Philips, Magnavox, Rola, MSP Speakers. Thorens, Dual, Philips, Garrard and Collaro Players and Changers. Speaker Enclosures and Control Cabinets. Sarlon and Tygan Cloth, Diamond Stylii, Dust Bugs, A.R.U.s, etc. Decca and Ortofon pickups.

TRADE-INS ACCEPTED. TERMS AVAILABLE

ALBERT WRIGHT
793 New Canterbury Road,
Hurlstone Park. N.S.W.
LL2696. TRADE SUPPLIED.

N.B. We are OPEN Saturdays.

For anything and everything for the HI-FI STEREO ENTHUSIAST

Labcraft

STEREO TURNTABLE TYPE 573V

Complete with Ronette Crystal Cartridge No 105, Arm and Switch. Adjustable Stylus pressure.

Transcription quality at a reasonable price.

ABSOLUTELY ZERO RUMBLE, WOW, AND FLUTTER.

Made in Denmark.

Samples now available to Trade. Stocks arriving. Attractive quantity discounts.

G. R. D. INSTRUMENTS PTY. LTD.
6 Railway Walk, Camberwell, Vic.
Tel. 82-1256.

WANTED TO BUY, SELL OR EXCHANGE

Advertisements may be inserted in these columns at a cost of 3/6 per line, each line containing approximately five words. To ensure publication, copy and cash must reach the office by the first of the month preceding date of issue. The envelope should be addressed, "Advertising Department, Radio, Television and Hobbies," Box 2728, G.P.O., Sydney.

ALL back issues R. TV & H. in stock at all times. 1939-56 copies 1/- ea. 1957 on 2/6 ea. Post included. Phone write or call, **T. Weir, 56 O'Connor Street, Haberfield, Sydney. UA2569.** Will buy copies locally.

BUY: Feedback type cuttinghead, low Imp. pref. **Brown, 1 Waverley, Hobart.**

FOR SALE: Back numbers "Radio and Hobbies," 1939 to 1954, 1/6; 1955 to 1957, 2/; 1958, 3/; 1959 to 1960, 4/, each including postage. **A. J. Cox, 13 Glover Street, Belmont, N.S.W.** Also will buy 1939, 1940, 1941, 1942, 1953, 1955 to 1960 copies.

FOR SALE: Brand new 21 Alpha TV tube, £15. Also A. and R. Hi-Fi output transformer, 20-20,000 C.P.S. 2-8 ohms. £2. **JJ6076.**

FOR SALE: Capacity operated switch. Suitable for window display, burglar alarms, etc. £23. **27 Dennistoun Avenue, Guildford, N.S.W. YU7926.**

FOR SALE: High Quality Test Equipment Hi Fi Sets, Radio Parts. Owner going overseas. **9 Empress Road, East St. Kilda, Melb., Vic. LB2824.**

FOR SALE: Longest TV repair business. Centrally located (Prahran-St. Kilda Area), W.I. W.O. Best offer. For details apply, **1 Kathleen Ave., Buleen, Vic. Phone 819201.**

FOR SALE. Siemens 16mm sound film projector. Has had 10 hours' use, cond. as new. Fitted for C/Scope and standard films. £375. **Mr P. DeBono, 23 Cobalt St., Broken Hill.**

FOR SALE: Wide World Magazines, 1929-1960, 1/. Life Magazines, 1/. Pix Magazines, 6d. National Geographic Magazines, 3/. Walkabout, 1/. All in good order. **35 Merriwa Street, Katoomba, N.S.W.**

MODEL ENGINEERING SUPPLIES. Blue Prints, Castings for Miniature Engineering requirements. **Bolton, 72 King Street, Sydney.** Catalogue 6/.

REPAIRS to Radio, TV, Xmtrs; Construction, Wiring and Testing TV alignment. **Eccleston Electronics, 146a Cotham Road, Kew, Vic. WY3777.**

SELL BC348 Communications Receiver, Range to 30 mc/s OSer 50kc if's DC "S" Meter Extra Audio Matched SPKR and Cabinet P Pack. £38/10/. Philips Communications Receiver, Range to 20 mc/s. "S" meter P. Pack, etc. £22/10/. 3 Tube High Gain RF Preselector 7-30 mc/s approx. £3/15/. Wanted, 22 or 122 set. **A. Shaw, c/- P.O., South Brisbane.**

SELL: Mast 50ft Pop-up five section galv. piping. Guy wire. £21, plus freight. **F. Mercovich, 263 Wood Street, Preston, N.18, Victoria.**

SELL: Television alignment equipment. A.W.A. Sweep Gen. Type 1A56036 0-50mc and channels 1 to 10. Price £125. Advance Marker Gen. Type 62 100 Kc to 220 Mc on fundamentals. Price £45, as new with instruction books. **Ring UY6795 after hours.**

SELL: Transformer, Ferguson OP 301 p.p. 15 and 3.75 ohms. Brand new. **Phone MW0522, ext. 301.**

SELL: Two 17 watt Playmaster amplifiers c/w No. 6 control boxes. cheap. **25 Wentworth Street, Parramatta, N.S.W. YL8231.**

SERVICING TRANSISTOR RECEIVERS. Pettit's book is a winner! Available from all leading booksellers or **Electronics Publications, 11 Cadow Street, Pymble, N.S.W.** (8/9, N.Z.)

TATTOOING: Electric Machines, Pigments, Design Sheets, Spare Machine Parts, Instruction Booklets and Blue Prints. Send 2/ for catalogue to **Johnny Lee, Box 34, Ivanhoe, Victoria.**

TELEFUNKEN Tape Recorder, Model KL35. Demonstration model. Completely overhauled. Complete with high-quality Microphone and Reel of Tape. To clear at £70. **Manufacturers Special Products Pty. Ltd., B0233, ext. 210.**

TELEVISION TUNER, Philips AT7580, near-new, done approx. 50 hrs. £12 or best offer. Write **92 Mitre Street, Bathurst.**

THE RADIO AMATEUR'S HANDBOOK (19 Edn.). Another huge shipment is in fr America. Lowest price in Australia—46/6. **Electronics Publications, 11 Cadow Street, Pymb N.S.W.** Mail order only.

USING AN OSCILLOSCOPE. Sales of t book are breaking all records. Priced 9/6 (N.Z. 7/6), from all leading bookshops, **Electronics Publications, 11 Cadow Street, Pymb N.S.W.**

WE offer you our experience, accuracy a craftsmanship in repair, calibration a alteration of electrical measuring instrumen Instrument maker, **W. Peterson, 41 Swift Stre Thornbury, Victoria.**

ANSWERS TO CORRESPONDENTS

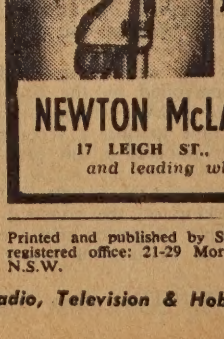
(Continued from page 123.)

Amplifier of January, 1959, when a 3. ohm voice coil replaces the 15 ohm ty specified.

A.: This is not a difficult calculatio C.R.H. Simply find the ratio of the tw voice coil impedance (4 to 1 in this cas extract the square root (2 in this cas and use this figure as a correction fact for the feedback components. Since t voltage developed across the lower i pedance voice coil will be lower, t feedback resistor must be reduced, this case by 2 to 1, making it 3400 ohm or 3300 in the nearest available co mercial figure.

In regard to the capacitor it cannot too strongly emphasised that the pro lem is much more complex. If t transformer had identical characteri tics in every other respect, then it wou be simply a matter of increasing it the same factor. However, this is mo unlikely, and this value should be chos experimentally if at all possible by obse vation of square wave performance.

AWA RONETTE
MICROPHONES & ACCESSORIES



Types GS210.
High Impedance.

£9/19/-

GS210/L Low Impedance (200 ohms).

£15/3/3

Both models fitted with on-off switch.

NEWTON McLAREN LTD.
17 LEIGH ST., ADELAIDE,
and leading wholesalers

Printed and published by Sungravure Ltd., at registered office: 21-29 Morley Avenue, Rosebe N.S.W.